AD-A105 650 REITZ AND JENS INC ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. ROBERT SCHULTEHENRICH DAM (MO 3029--ETC(U)
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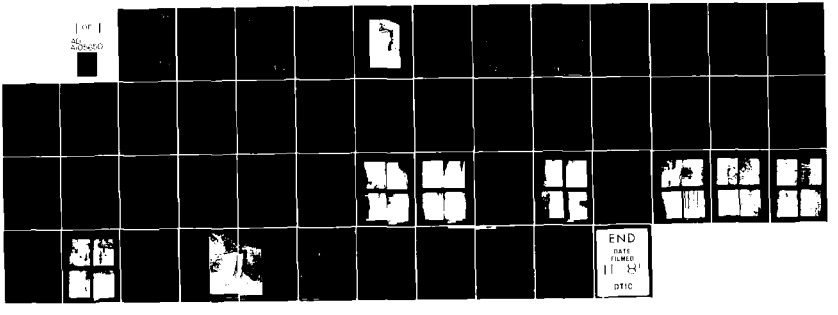


LEVEL II

(1)

MISSOURI-KANSAS CITY BASIN

ROBERT SCHULTEHENRICH DAM

ST. CHARLES COUNTY, MISSOURI

MO 30294

(9) Final rept.,

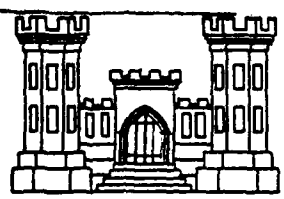
15 DACW43-78-C-0162

(10) Henry M. /Reitz John J. /bailey, Jr

PHASE 1 INSPECTION REPORT

(6) NATIONAL DAM SAFETY PROGRAM.

Robert Schultehenrich Dam (MO 30294),
Missouri - Kansas City Basin, St. Charles
County, Missouri. Phase I Inspection Report.



PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A105 650	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Robert Schultehenrich Dam (MO 30294) St. Charles County, Missouri		5. TYPE OF REPORT & PERIOD COVERED Final Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Reitz & Jens, Inc.		8. CONTRACT OR GRANT NUMBER(s) DACW43-78-C-0162
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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Robert Schultehenrich Dam, MO ID No. 30294
Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Robert Schultehenrich Dam:

It was prepared under the National Program of Inspection of Non-Federal Dams

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1)Spillway will not pass more than 10% of the Probable Maximum Flood without overtopping the dam.

2) Overtopping could result in dam failure.

3) Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: SIGNED 12 MAR 1979
Chief, Engineering Division — Date

APPROVED BY: SIGNED 12 MAR 1979
Colonel, CE, District Engineer — Date

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PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Robert Schultehenrich Dam
State Located	Missouri
County Located	St. Charles County
Stream	Unnamed Tributary to East Branch of Lake Creek
Date of Inspection	20, 25 September 1978 and 24 October 1978

Robert Schultehenrich dam was inspected by an interdisciplinary team of engineers from Reitz & Jens, Inc. under contract with the St. Louis District Corps of Engineers. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations and private engineers. Based on these guidelines, this dam is classified as a small dam with a high downstream hazard potential. The estimated damage zone from failure of the dam extends three miles downstream from the dam.

Failure would threaten the life and property of three families and cause appreciable damage to associated farm buildings and one power transmission line.

Our inspection and evaluation indicates the dam is deficient in that the spillways are inadequate. Considering the small volume of water impounded, the large floodplain downstream and the three groups of farm buildings downstream, one-half PMF is the appropriate spillway design flood. The dam will begin to be overtopped by a 10% PMF. The dam will also be overtopped by a 100-year frequency flood.

Other deficiencies observed were steep downstream slope, lack of wave-wash protection on the upstream face of the dam, lack of erosion protection in the emergency spillway, heavy growth of trees on the slopes of the dam and lack of seepage and stability analyses records.

These deficiencies are further discussed in the attached report.

We recommend the owner take action to correct or control the deficiencies described.

HENRY M. REITZ, President
Reitz & Jens, Inc.

JOHN J. BAILEY, JR., Vice President
Chief Engineer
Reitz & Jens, Inc.

OVERVIEW – 30294

PLATE 1

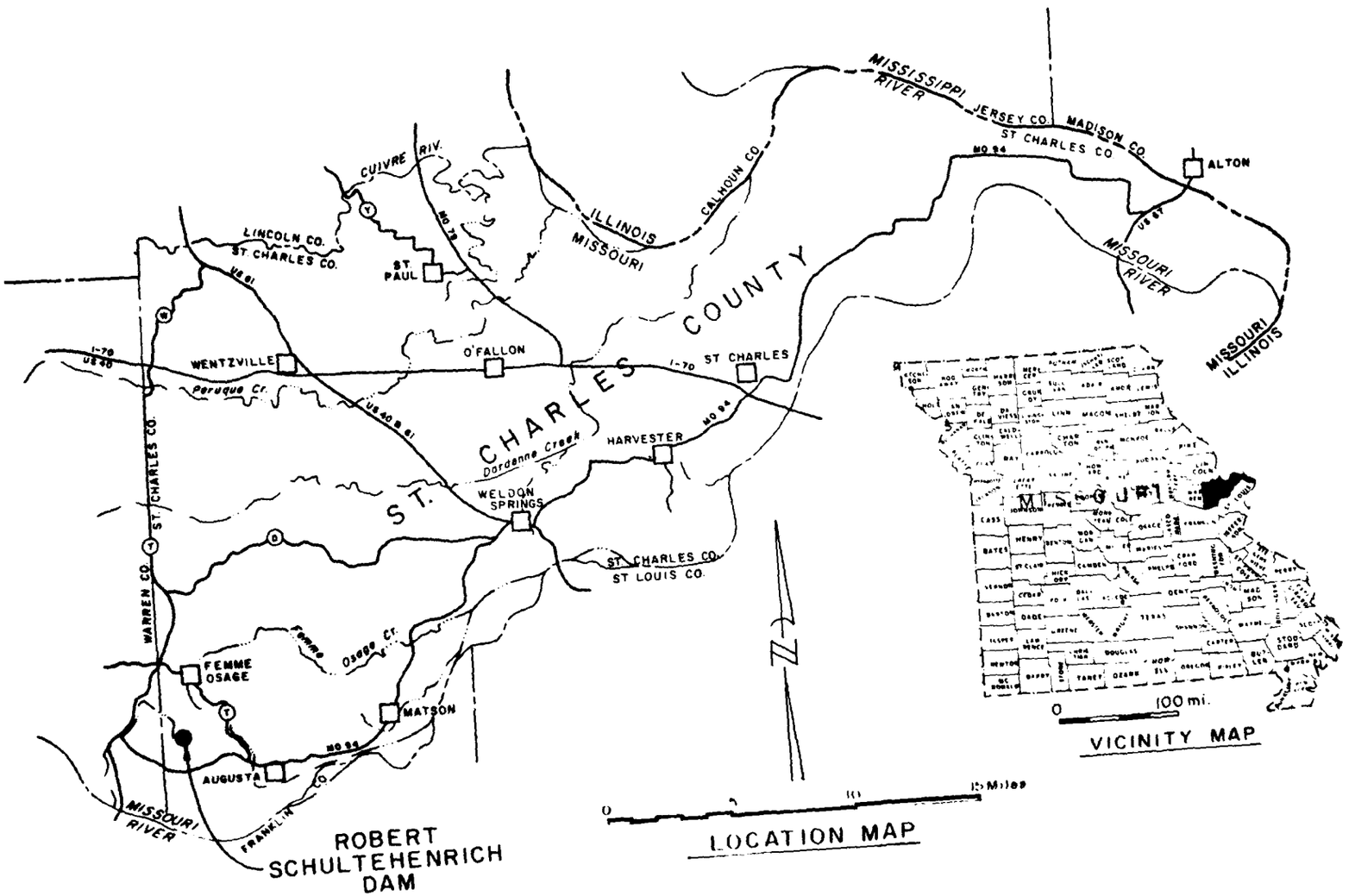
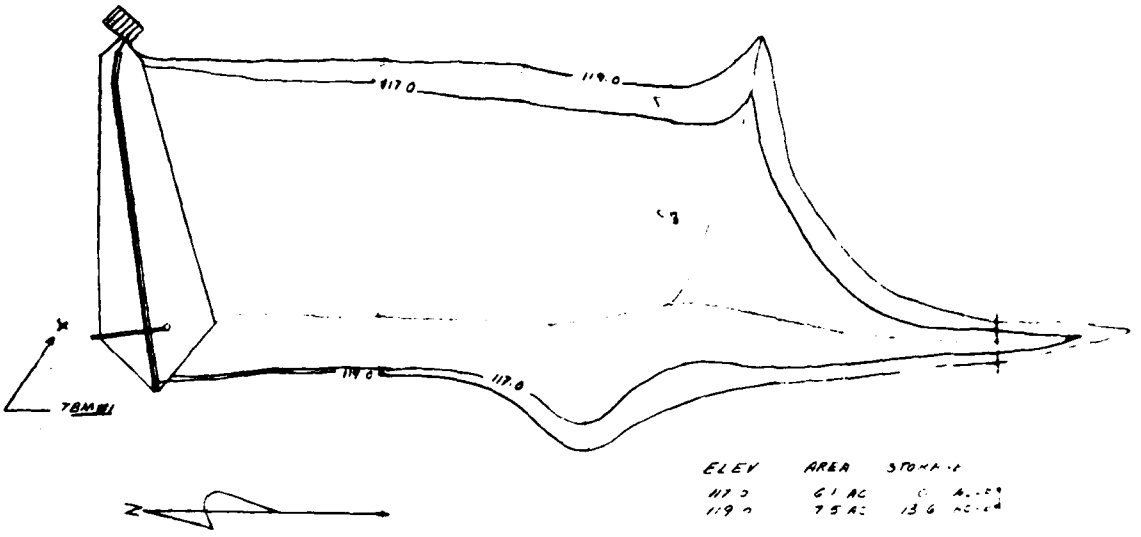

MISSISSIPPI RIVER
JERSEY CO.
MADISON CO.
ST CHARLES CO.
ALTON
MO 94
US 67
MISSOURI RIVER
MISSOURI
ILLINOIS
CALHOUN CO
ILLINOIS
MISSOURI
CUIVRE RIV.
MO 79
LINCOLN CO.
ST. CHARLES CO.
US 61
ST. PAUL
I-70
US 40
WENTZVILLE
O'FALLON
I-70
ST CHARLES
Peruque Cr.
US 40 & 61
HARVESTER
MO 94
ST. CHARLES COUNTY
Dardenne Creek
WELDON SPRINGS
ST. CHARLES CO.
ST LOUIS CO.
WARREN CO.
ST. CHARLES CO.
Femme Osage Cr.
FEMME OSAGE
MATSON
MO 94
AUGUSTA
MISSOURI RIVER
FRANKLIN CO.
ROBERT SCHULTEHENRICH DAM
0
5
10
15 Miles
LOCATION MAP
MISSOURI
0
100 mi.
VICINITY MAP

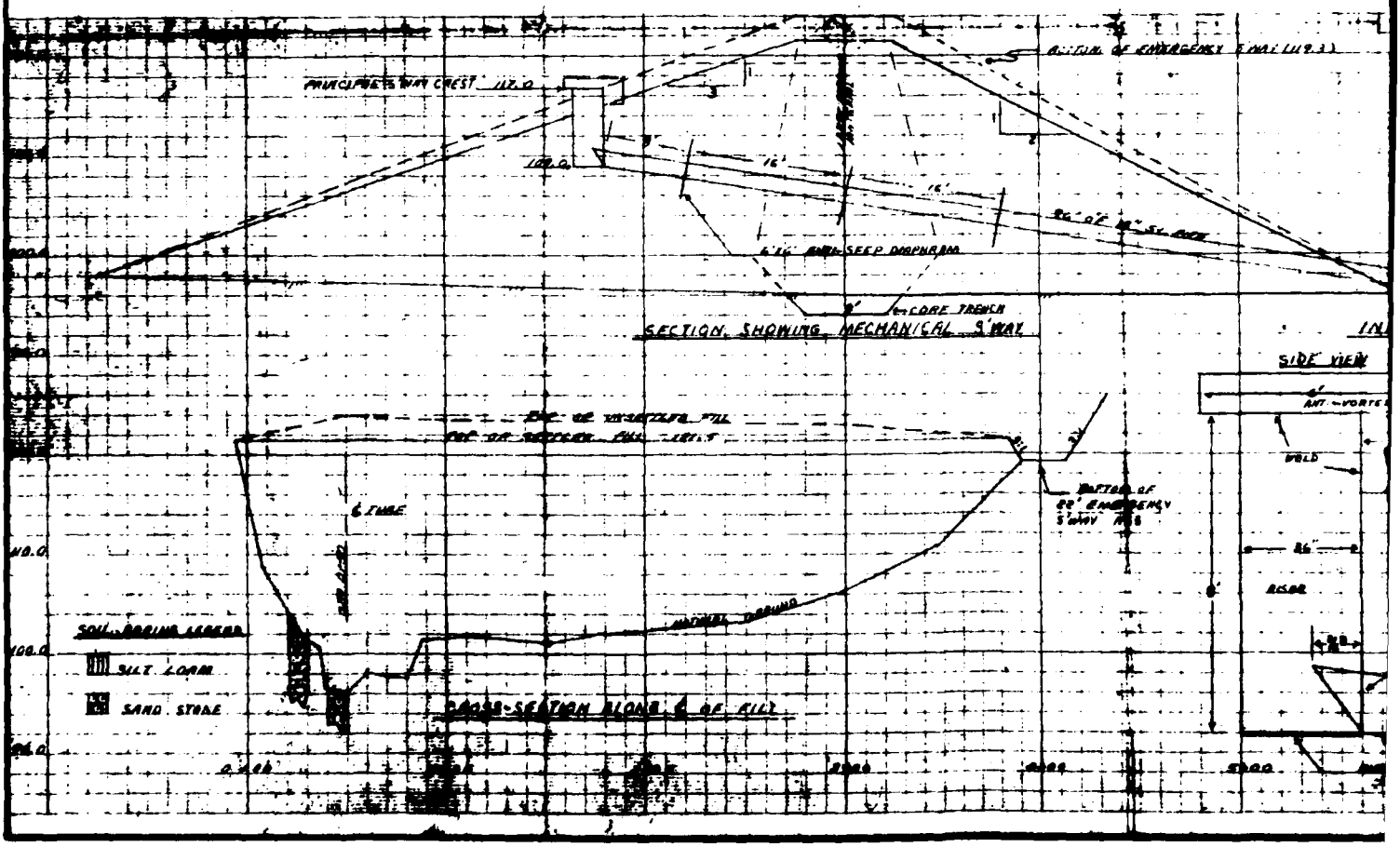
PLATE 2

LAYOUT PLAN



ELEV	AREA	STORAGE
117.0	6.1 AC	0 AC-FT
119.0	7.5 AC	13.6 AC-FT

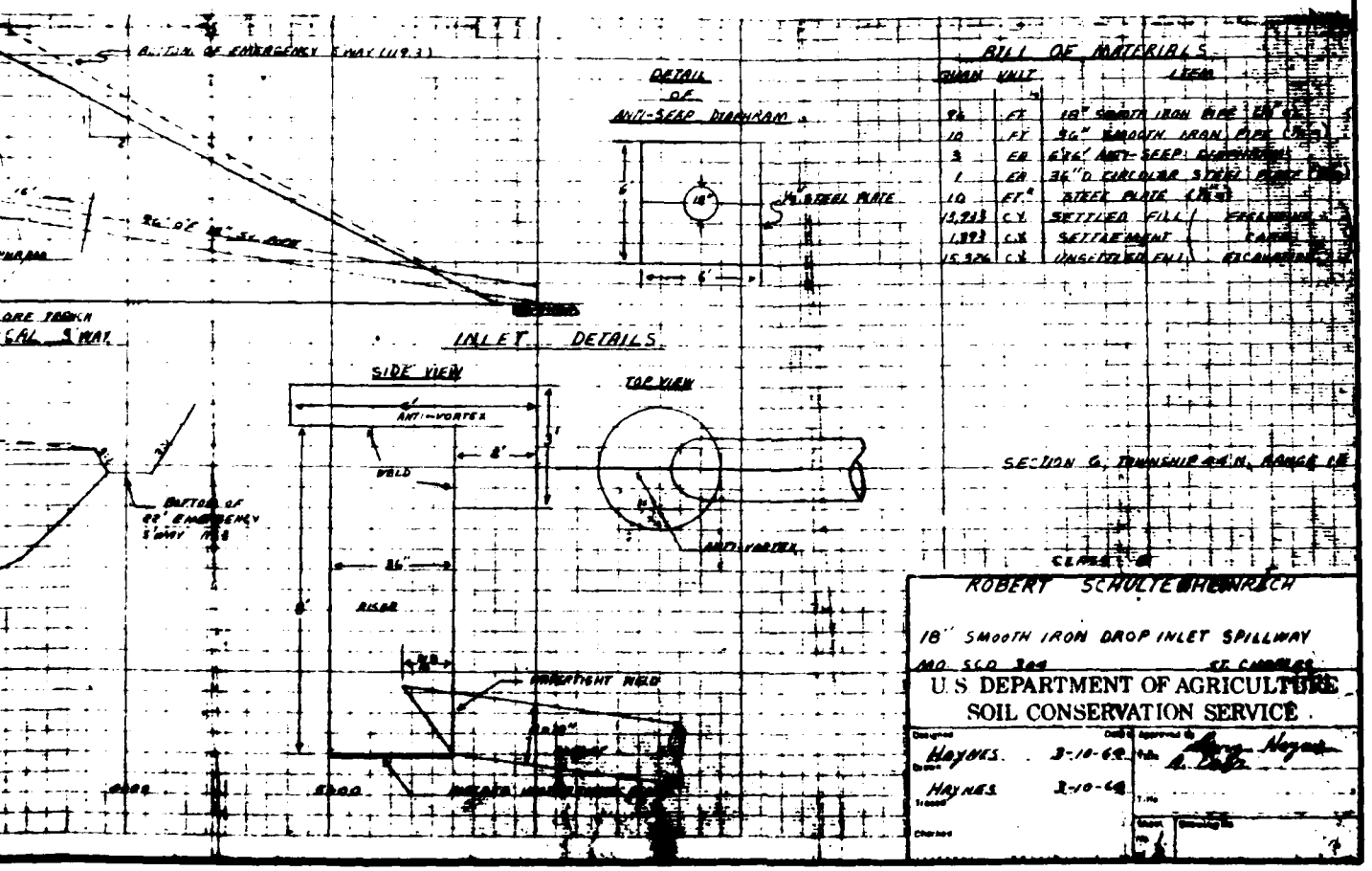
TBM #1 - OH NAIL IN S SIDE OF 16" SYCAMORE TREE & STREAM BELOW FILL SITE (100.0')



WATERSHED MAP

AREA STORAGE

61 AC
75 AC



BILL OF MATERIALS

QUAN	UNIT	ITEM
96	FT	18" SMOOTH IRON PIPE
10	FT	36" SMOOTH IRON PIPE
2	EA	6'x6' ANTI-SEEP DIAPHRAGMS
1	EA	36"D CIRCULAR STEEL RISER
10	FT²	STEEL PLATE (1/4")
13,733	C.Y.	SETTLED FILL
1,893	C.Y.	SETTLEMENT
15,926	C.Y.	UNSETTLED FILL

ROBERT SCHULTE-SHERWRICH

18" SMOOTH IRON DROP INLET SPILLWAY

MO SCS 304

ST. CHARLES

U.S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed HAYNES 3-10-64
Drawn HAYNES 3-10-64
Traced
Checked

Approved by [signature] Date
Title
No. 4

2

PLATE 4

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
Robert Schultehenrich Dam - ID No. MO 30294

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(Cont.)

LIST OF PLATES

LIST OF INDICES AND PHOTOGRAPH NUMBERS

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority The National Dam Inspection Act, Public Law 92.367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer, contracted with Reitz & Jens, Inc. (Contract DACW43-78-C-0162) for a safety inspection of the Robert Schultehenrich Dam ID No. MO 30294.

b. Purpose of Inspection The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances The dam is built at the lower end of a draw in steep, hilly ground, at the upper end of the floodplain, at the east branch of Lake Creek. Except for a small area on the east shore of the reservoir and narrow strips on the ridges which are in pasture, the entire watershed is in forest. The forested area may amount to 95% of the total. About 75% of the soil in the watershed is classified as steep, stony land with thin, stony loam covering partially weathered limestone and chert. The remainder of the soils in the watershed are about 22% Silt Loam and less than 3% of Huntington and Weldon Silt Loams on the ridges. The valley beneath the reservoir appears to be at the top of St. Peters Sandstone. The hillsides are in the overlying Joachim and Plattin dolomites and limestones.

Average slopes in the watershed average 18%.

The dam is built in an essentially east/west direction with a pipe spillway near the east end discharging toward the channel of the east branch of Lake Creek and an emergency overflow spillway at the east end which discharges onto the hillside south of the creek.

Topography in the vicinity of the dam is shown on Plate 3.

Pertinent physical data are given in paragraph 1.3 below.

b. Location The dam is located in extreme southwest St. Charles County in the SW¼ of the SE¼ of Section, 31, T45N, R1E, and is about two miles east of the Village of Dutzow in Warren County, as shown on Plate 2. The lake formed by the dam is shown on the 1972 Edition of the USGS Washington East Quadrangle.

c. Size Classification Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1.c above. Based on these criteria this dam and impoundment is in the Small Size Category.

d. Hazard Classification Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph c above. Based on referenced guidelines, this dam is in the High Hazard Classification.

e. Ownership This dam is owned by Mr. Robert Schultehenrich, mailing address: 9 Oxford Place, St. Charles, Missouri, 63301.

f. Purpose of Dam The dam forms a 7.8-acre recreational lake.

g. Design and Construction History The inspection team obtained a single plan profile sheet from the United States Department of Agriculture, Soil Conservation Service, Columbia, Missouri, dated March 10, 1964, which is included herein as Plate 4. No other design and construction records were made available by the SCS. The owner could not make any plans available to the inspection team.

h. Normal Operating Procedure Normal rainfall, runoff, transpiration, evaporation and discharge through the drawdown tube all combine to maintain a relatively stable water surface elevation. Maximum water depth ever experienced at the spillway is unknown.

1.3 PERTINENT DATA

a. Drainage Area - 288 acres

b. Discharge at Damsite

(1) Discharge at the damsite is through an uncontrolled drawdown tube principal spillway and an emergency spillway channel at the east end of the dam.

(2) Estimated experienced maximum flood at damsite - unknown.

(3) Estimated ungated spillway capacity at top of dam (elev. 639.5):
Drawdown tube - 34 cfs
Emergency Spillway - 72 cfs
Total - 106 cfs

c. Elevation (Feet Above M.S.L.)

(1) Top of dam - 639.5 to 642.1± (see Plate 3).

(2) Spillway Crest - 635.0 top of drawdown tube
638.1 emergency spillway

(3) Streambed at centerline of dam - 613.3 (est.)

(4) Maximum tailwater - unknown.

d. Reservoir

(1) Length of maximum pool - 950 feet ±.

(2) Length of normal pool - 875 feet ±.

e. Storage (Acre-Feet)

(1) Top of dam - 122 acre feet

(2) Normal pool - 75 acre feet

f. Reservoir Surface (Acres)

(1) Top of dam - 13.3 acres (estimated).

(2) Emergency spillway crest - 7.8 acres (estimated).

(3) Primary Spillway - 5.7 acres.

g. Dam

(1) Type - earth embankment

(2) Length - 450 feet (excluding spillway)

(3) Height - 29.5 feet maximum (from survey)

(4) Top width - 11 feet

(5) Side Slopes -

(a) Downstream - 1V on 1.6H upper 18 feet and 1V on 2.0H lower 20 feet (determined from section at 4+17).

(b) Upstream - 1V on 3.0H (to water surface).

(6) Zoning - unknown

(7) Impervious core - unknown

(8) Cutoff - unknown

(9) Grout Curtain - unknown

h. Diversion and Regulating Tunnel - None

i. Spillways

(1) Principal Spillway - 36-inch diameter uncoated steel drop pipe 8 feet deep with anti-vortex baffle and trash bars. Rim of drop pipe at elevation 635.0. Outlet 18-inch diameter uncoated steel pipe at 10.5% grade. Discharges to watercourse of the east branch of Lake Creek below dam. Spillway is near east end of dam.

(2) Emergency Spillway - Unlined earth channel about 1.5 feet deep. Top width about 45 feet. Bottom width about 20 feet. Crest elevation 638.1. Spillway crosses axis of dam at 45° angle at east end. Discharge is onto valley slope about 50 feet from east end of dam. No downstream channel exists.

j. Regulating Outlets - None

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Plan Sheet included herewith as Plate 2 was obtained from the USDA SCS. No design calculations were made available. Plans are dated 3/10/64. They were designed, drawn and checked by Larry Haynes, Agricultural Engineer. Sheet 1 of 2 was the only one available of two sheets.

a. Principal Spillway A drawdown tube spillway was designed with a 36-inch diameter 8-foot deep drop pipe or riser at the upper end of an 18-inch steel pipe through the dam. Anti-seep diaphragms 6 feet square are called for at the centerline and 16 feet either side of the centerline of the dam.

b. Emergency Spillway An emergency spillway channel excavated in the east abutment is indicated on the plans. This was to have a 22-foot bottom width and 1V on 3H side slopes. Flowline of this channel is shown 2.0 feet below crest of dam and 2.3 feet above the lip of the drop pipe.

c. Dam The upstream and downstream slopes are shown as 1V on 3H and 1V on 2H, respectively. Top width is shown as 10 feet. A 10% settlement allowance was called for, resulting in a 2.5-foot variation in constructed crest elevation. Two borings indicate sandstone at the west abutment near the existing watercourse. An 8-foot bottom width cutoff "core" trench is shown on the dam section but the longitudinal extent is not depicted on the plans. It appears that a core was intended to be constructed with "least pervious material". No evidence indicating that a seepage and stability analysis was made is available.

2.2 CONSTRUCTION

No construction records were available from the SCS or the owner. The name of the construction contractor, if any, is unknown. The SCS reported that construction was completed in 1965 but no "as-built" survey was available nor were "as-built" notes placed on the plan sheet.

2.3 OPERATION

Lake levels remain stable during average precipitation of 38 inches per year. It appears from the condition of the emergency spillway that water has flowed over it on many occasions since completion. No facilities requiring operation exist. The maximum loading on the dam is unknown.

2.4 EVALUATION

a. Availability One sheet of construction plans was available. Design calculations were not available.

b. Adequacy It is reasonable to infer from the use of standard SCS settlement allowances and principal spillway details that hydrologic and hydraulic calculations were performed in accordance with standard SCS practice and probably included on the missing second sheet of plans. However, the information on the single sheet of plans was not adequate to make a detailed assessment of the design and construction of the dam.

Even so, a defensible evaluation of the structure could be made, based on the survey measurements; the observations of the inspection team and by giving due consideration to the age and general condition of the structure, its size and the materials used to build it. Seepage and stability analyses are not on record.

The owner should have an engineer experienced in the design of dams perform detailed seepage and stability analyses.

c. Validity This report is primarily for safety through maintenance and operation and the conclusions and evaluation for this Phase I inspection are considered adequate for the definitive statement in this report.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General A visual inspection of the Robert Schultehenrich dam was made on 24 October 1978. This followed four days of field measurements by a survey party on 20, 21, 22 and 25 September 1978. The training and experience of personnel in these inspections included hydrologic, hydraulic enginering, soils and materials engineering, surveying and structural engineering. This section only states those aspects visually observed during the inspection. It does not comment upon items reported to have been installed which were not evident during September and October.

b. Dam The dam is an earthen dam; top width 11± feet (Photo D-7). Average downstream slope 1V on 2H. Upstream slope 1V to 3H down to the lake surface. The maximum height is 29 feet; the length approximately 450 feet. The elevation of the top of dam varied approximately 2½ feet. The high point is in the central section of the dam, sloping off to the emergency spillway on the east section of the dam and the valley slope on the west end.

There is no erosion protection on the reservoir side of the dam (D-3, D-6, D-8). The slope above the crest elevation of the primary spillway is covered with a mixture of saplings and weeds. The downstream slope is covered with fairly dense shrub-type growth and a few saplings (D-1, D-2, D-4, D-5).

Inspection of the downstream slope of the dam and contiguous areas beyond the toe of slope indicated neither the growth of hydrophilic plants nor any soft, wet areas, nor even greater degree of free water at the surface. As such, there was no sign of through seepage on the dam; neither was there any sign of seepage along the contact between the toe of dam and the original ground surface or in the natural flat grade between the dam and edge of the main channel of the east branch of Lake Creek that roughly parallels the alignment of the dam (V-1, V-3, V-3, V-4).

c. Spillways The principal spillway is a 3-foot diameter, heavy-walled steel drop pipe with horizontal lip and a vertical steel plate anti-vortex baffle as well as some vertical trash rack posts projecting approximately 3 feet above the baffle (S-3, S-4, S-8). This pipe has a vertical drop of approximately 8 feet. At the bottom the discharge is conducted laterally in a 125-foot long 18-inch pipe on an approximately 10.5% uniform grade. The outlet of this 18-inch pipe is at the edge of the natural creek channel about 50 feet beyond the toe of dam (S-5, V-2, V-4). The emergency spillway is on the east end of the dam. The emergency spillway was excavated in virgin soil (S-1, S-6). The spillway excavation, while it was of relatively small volume, apparently was incorporated into the dam. The hydraulic characteristics of this spillway are not adversely affected by the presence of a sun roof which has been constructed in the channel on the reservoir side of the crest (S-7).

On the reservoir side of the dam there is some minor erosion; however, the capacity of the principal spillway appears to have confined the effects of the erosion to the vertical zone between the top of drop pipe and the low point of the emergency spillway.

Overtopping flow would start at the west end of the dam. A steel water tank at that location could float and be dislodged.

d. Reservoir Area No wave-wash, excessive erosion or slides were observed along the shore of the reservoir (P-1, P-2, P-3, P-4).

3.2 EVALUATION

a. Dam A potential of failure exists because of the heavy growth on both slopes of the dam. Shrub growth provides shelter and habitat for rodents whose burrowing activity might cause detrimental seepage. Furthermore, seepage through the embankment and sloughing may occur as the roots decay. The bush and tree growth should be removed, then turf established. The upstream slope of the dam consists of fine-grained soil. This should be protected against wave-wash with an armor-coat of stone or broken concrete riprap.

b. Spillway It appears to the inspection team that construction of the sun roof in the spillway is inadvisable because it may set a precedent for placing other structures in the emergency spillway that could adversely affect the hydraulic capacity.

The emergency spillway channel could erode and possibly endanger the dam. An erosion resistant sill should be provided at the crest. The berm at the east end of the dam is not high enough to contain maximum spillway discharges in the spillway channel. This berm should be raised to top of dam elevation along the west side of the spillway channel.

c. Downstream The channel of the east branch of Lake Creek flows near the toe of the dam. The distance from the toe of the dam is sufficient to eliminate any danger of the toe of the dam being eroded by meandering of the creek channel.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

There are no controlled outlet works for this dam; therefore, no regulating procedures exist. The pool is controlled by rainfall, runoff, evaporation and capacity of the uncontrolled spillways.

4.2 MAINTENANCE OF DAM

Based on the amount of brush and size of trees on the dam and the visual observation of the inspection team, little if any maintenance has been performed on this dam for many years. The emergency spillway channel is used for recreational purposes and appears to be occasionally mowed to control weed growth.

4.3 MAINTENANCE OF OPERATION FACILITIES

No operating facilities exist at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

The inspection team is not aware of any existing warning system for this dam.

4.5 EVALUATION

If the uncontrolled vegetation on the dam is allowed to continue, a serious potential of failure may develop.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data No design data are available except as may be inferred from the single plan sheet of plans included as Plate 4.

b. Experience Data The drainage area is developed from USGS Washington East, Missouri Quadrangle. Also available are 1"=2000' aerial stereo pairs taken 22 March 1977, by Surdex Corporation. Lake area is measured on a 1"=200' enlargement of a portion of one of these photographs and shown on Plate 1. The spillway and dam layout are from surveys made during the inspection.

c. Visual Observations

(1) The steel droppipe and outlet pipe are in good condition. Discharge of the outlet pipe is onto solid rock.

(2) No drawdown facilities are available to evacuate the pool.

(3) The emergency spillway and exit channel are located at the east end of the dam. Continued discharge of water through this unlined channel could lead to erosion and degradation of the crest of the spillway. The lowest part of the dam adjoins the emergency spillway. When flows in the emergency spillway approach top of dam elevation, flow will start to discharge laterally and flow down the contact between the toe of the dam and the valley. If no erosion protection is provided, the integrity of the dam and embankment would be threatened.

d. Overtopping Potential The spillways are too small to pass the minimum required flood of one-half the probable maximum without overtopping the dam. The probable maximum flood (PMF) is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions reasonably possible in the region. The dam will start to be overtopped by a flood equal to 10% of the PMF, at which point the combined spillway capacities are 106 cfs. The one-half PMF will overtop the dam to a maximum depth of about 2.4 feet. The depth will vary to zero across the dam because of the sloping crest. Nearly the entire length of the dam crest will be subject to some overtopping flow at peak discharge. Maximum rate of flow over the dam crest will be about 1400 cubic feet per second. Overtopping flow will have a duration of 7.5 hours. The existing spillways are inadequate to pass a 100-year frequency flood without overtopping the dam.

Large emergency spillway flows occurring even before the dam is overtopped could endanger occupants of the small cottage between the dam and emergency spillway, at the east end of the dam.

The effect from rupture of the dam could extend three miles downstream of the dam. Within the damage zone are three farmhouses, associated farm buildings and a power transmission line.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations Visual observations which adversely affect the structural stability of this dam are discussed in Section 3, paragraph 3.1.b.

b. Design and Construction Data No design or construction data relating to the structural stability of the dam were found except the single plan sheet. No seepage or stability analysis is available.

c. Operating Records No appurtenant structures requiring operation exist at this dam.

d. Post Construction Changes No post construction changes exist which will affect the structural stability of the dam.

e. Seismic Stability Considering the seismic zone (2) in which this dam is located, an earthquake of this magnitude is not expected to cause a structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety The spillways are inadequate to pass the required one-half Probable Maximum Flood. Several items were noted during the visual inspection by the inspection team which should be corrected or controlled. The vegetation growing on the upstream and downstream slopes of the dam is a safety deficiency. An armor-coat to protect the reservoir slope of the dam against wave-wash is needed. Erosion protection for the emergency spillway is deficient. The principal spillway pipe under the dam could corrode and leak allowing soil to migrate from within the dam embankment. Seepage and stability analyses are not on record; this is a deficiency which should be rectified.

b. Adequacy of Information Due to the lack of complete engineering design and construction data, the conclusions in this report were also based on performance history and external visual conditions. The inspection team considers these data sufficient to support the conclusions herein.

c. Urgency The remedial measures recommended in paragraph 7.2 should be accomplished in the near future. If the safety deficiencies listed in paragraph a are not corrected in the near future, they will continue to deteriorate and lead to a serious potential of failure.

d. Necessity for Phase II Based on the results of the Phase I inspection, no Phase II inspection is recommended.

e. Seismic Stability This dam is located in Seismic Zone 2. An earthquake of this magnitude is not expected to be hazardous to this dam.

7.2 REMEDIAL MEASURES

a. Alternatives Spillway size and/or height of dam should be increased to pass one-half PMF without overtopping the dam. The owner should engage an engineer experienced in the design and construction of dams to design and supervise execution of corrective construction which would also include wave-wash protection on the reservoir slope of the dam, an erosion resistant sill in the emergency spillway and removal of growth on the dam and establishment of turf on the slopes. All corrective measures undertaken should be documented for the record, including "as-built" surveys, plans, construction records and tests and reports of inspection during construction.

b. Stability and Seepage Analyses The owner should have an engineer experienced in the design and construction of dams prepare seepage and stability analyses.

c. O&M Maintenance and Procedures The following O&M maintenance and procedures are recommended:

(1) Periodically check the condition of the 18-inch steel pipe through the dam for evidence of corrosion and leakage. Water leaking into

or out of a corroded principal spillway pipe could cause piping failure of the earth embankment.

(2) Maintain the trash rack at the inlet of the principal spillway. Remove accumulations of trash which, if left in place, could eventually greatly reduce the capacity of the structure.

(3) After removal of existing growth, vegetation on the dam should be periodically cut.

(4) Maintain an erosive-resistant sill on the control section of the spillway.

(5) The owner should keep a record of all future repairs and maintenance.

(6) A detailed inspection of the dam should be made periodically by an engineer experienced in design and construction of dams. Records should be kept of these inspections.

APPENDIX A

Hydrologic Computations

HYDROLOGIC AND HYDRAULIC ANALYSIS METHODOLOGY

1. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for a reservoir routing. The Probable Maximum Precipitation for those dams in the High Hazard Potential Category is derived and determined from regional charts prepared by the National Weather Service in "Hydrometeorological Report No. 33". Reduction factors have not been applied. A 24-hour storm duration is assumed with the 24-hour rainfall depths distributed over 6-hour periods in accordance with procedures outlined in EM 1110-2-1411 (SPF Determination). The maximum 6-hour rainfall period is then distributed to hourly increments by the same criteria. Within-the-hour distribution is based upon NOAA Technical Memorandum NWS HYDRO-35. The non-peak 6-hour rainfall periods are distributed uniformly. All distributed values are arranged in a critical sequence by the SPF criteria. The final inflow hydrograph is produced by deduction of infiltration losses appropriate to the soil, land use and antecedent moisture conditions.

2. The reservoir routing is accomplished by using Modified Puls routing techniques wherein the flood hydrograph is routed through lake storage. Hydraulic capacities of the spillways and crest of dam are used as outlet controls in the routing. Storage in the pool area is defined by an elevation-area curve. The hydraulic capacity of the spillways and the sloping top of dam is defined by a composite elevation-discharge curve.

3. Dam overtopping analysis has been conducted by hydrologic methods for this dam and lake. This computation determines the percentage of the PMF hydrograph that the reservoir can contain without the dam being overtopped. An output summary in the hydrologic appendix displays this information as well as other characteristics of the simulated dam overtopping.

4. The above methodology has been accomplished for this report using the systemized computer program HEC-1 (Dam Safety Version), July 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. The numeric parameters estimated for this site are listed on Plate 1A. Definitions of these variables are contained in the "User's Manual" for the computer program.

5. At heads less than 0.6 foot, capacity of the principal spillway is determined by the rim of the drop pipe behaving as a sharp-crested weir. Length was assumed as the perimeter of the pipe and a discharge coefficient of 3.3 was used. At higher heads (above 1.0 feet) the hydraulic control is at the entrance to the 18-inch pipe through the dam at the bottom of the drop tube. The head-discharge relationship is determined by allowing one velocity head for energy in the 18-inch pipe and 0.5 velocity head for entrance losses at the upper end of the 18-inch pipe. Friction, velocity

head and entrance loss in the drop tube are added to give a total head above the top of the 18-inch pipe of 1.93 velocity heads. Friction in the 18-inch outlet pipe was not a control.

6. The capacity of the emergency spillway was calculated using critical depth and velocity at the control section which was found to be at a 45-degree angle to the axis of the dam through dam centerline Station 1+00. To allow for friction, velocity head changes and transition losses 0.2 velocity head was added when calculating reservoir elevations. Flow over the dam crest which is not all the same elevation was calculated using a discharge coefficient of 3.0 in the broad-crested weir equation for sections at various elevations. All principal spillway, emergency spillway and overtopping discharge was included in a composite rating curve. Dummy values of 0.1 for dam length, coefficient of discharge and exponent were entered on the $D card to suppress diagnostic statements in the output. The amount of this dummy flow is never greater than 0.02 cfs.

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  3 AUG 78
**********
    1              A  ********** ID # 30294 SCHULTEHENRICH DAM * ADD 535 FOR USGS ELEV ***
    2              A  ********** DAM SAFETY PROGRAM - U. S. CORPS OF ENGINEERS **********
    3              A  ********** REITZ & JENS, INC. -    AUGUST 1978 **********
    4              B    288       0         5        -0       -0       -0       -0       -0       -4       -0
    5              1      5
    6              J      1         9         1
    7              J1  0.10     0.15      0.20     0.25     0.30     0.35     0.40     0.50     1.00
    8              K      0    PMF                          1        3        1
    9              1  ***** INFLOW HYDROGRAPH - SCS METHOD *****
   10              M      1         2    0.451                          1                          1
   11              P              24.8      101      120      130
   12              T                                                    -1      -89                0.04
   13              H2             0.20
   14              X             -0.10      2.0
   15              K      1        03                          1        1
   16              1  ***** RESERVOIR ROUTING - RATING CURVE SUPPLIED - INCLUDES DAM ****
   17              Y                                    1        1
   18              Y1     1                                                -100.0       -1
   19              Y4 100.0    100.1     100.2    100.3    100.5    100.6    100.9    101.5    102.0    103.0
   20              Y4 103.5    104.0     104.5    105.0    105.5    106.0    106.5    107.0    107.5    108.0
   21              Y5   0.0      1.0       2.8      5.1       11       14       21       27       29       31
   22              Y5    36       53       106      229      469      868     1431     2215     3411     4904
   23              $A 0.00     7.81     13.77    28.47
   24              $F   71      100       105      125
   25              $$ 100.0
   26              $D 104.5      0.1       0.1      0.1
   27              K     99
```

PLATE A-1
Sheet 1 of 5

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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  3 AUG 78
**********************************

RUN  DATE= 10/05/78.
     TIME= 13.51.12.


* ********** ID # 30294 SCHULTENBRICH DAM # AND 535 FOR USGS FLEV ***
 ********** DAM SAFETY PROGRAM - U. S. CORPS OF ENGINEERS **********
 ********** REIT? & JENS, INC. -    AUGUST 1978 **********************

                                JOB SPECIFICATION
  NO      NHR     NMIN     IDAY      IHR     IMIN    METRC     IPLT     IPRT    NSTAN
 288        0        5       -0       -0       -0       -0       -0       -4       -0
                          IOPER      NWT    LROPT    TRACE
                              5       -0       -0       -0


                          MULTI-PLAN ANALYSES TO BE PERFORMED
                                NPLAN= 1 NRTIO= 9 LRTIO= 1
          RTIOS=     .10     .15     .20     .25     .30     .35     .40     .50    1.00


**********          **********          **********          **********          **********

                                SUB-AREA RUNOFF COMPUTATION

***** INFLOW HYDROGRAPH - SCS METHOD *****
                    ISTAO    ICOMP    IECON    ITAPE    JPLT     JPRT    INAME   ISTAGE   IAUTO
                    PMF          0       -0       -0       1        3        1       -0       -0

                                HYDROGRAPH DATA
     IHYDR     IUNG     TAPEA     SNAP     TRSDA     TRSPC     RATIO     ISNOW     ISAME     LOCAL
         1        2       .45    -0.00       .45      1.00   -0.000        -0         1        -0

                                PRECIP DATA
              SPFE      PMS       PA      P12      P24      P6R      P72      996
             -0.00    24.00   101.00   120.00   130.00    -0.00    -0.00    -0.00

                                LOSS DATA
        LROPT   STRKR    DLTKR    RTIOL    ERAIN    STRKS    RTIOK    STRTL    CNSTL    ALSMX    RTIMP
           -0    -0.00    -0.00     1.00    -0.00    -0.00     1.00    -1.00   -99.00    -0.00      .04

          CURVE NO =  -99.00  WETNESS =   -1.00  EFFECT CN =   99.00

                                UNIT HYDROGRAPH DATA
                             TC= -0.00    LAG=    .20

                                RECESSION DATA
                          STRTQ=   -0.00    QRCSN=    -.10    RTIOR= 2.00

     UNIT HYDROGRAPH 14 END OF PERIOD ORDINATES. TC=   -0.00 HOURS. LAG=    .20  VOL= 1.00
  220.      724.      899.      719.      400.      230.      130.       75.       43.       24.
   14.        8.        5.        2.

                                END-OF-PERIOD FLOW
 0
MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q       MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q
```

PLATE A-1
Sheet 2 of 5

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	.00	.01	0.	1.01	12.05	145	.21	.20	.01	351.
1.01	.10	2	.01	.00	.01	1.	1.01	12.10	146	.21	.20	.01	352.
1.01	.15	3	.01	.00	.01	1.	1.01	12.15	147	.21	.20	.01	477.
1.01	.20	4	.01	.00	.01	1.	1.01	12.20	148	.21	.20	.01	577.
1.01	.25	5	.01	.00	.01	2.	1.01	12.25	149	.21	.20	.01	634.
1.01	.30	6	.01	.00	.01	2.	1.01	12.30	150	.21	.20	.00	667.
1.01	.35	7	.01	.00	.01	2.	1.01	12.35	151	.21	.20	.00	686.
1.01	.40	8	.01	.00	.01	2.	1.01	12.40	152	.21	.20	.00	697.
1.01	.45	9	.01	.00	.01	2.	1.01	12.45	153	.21	.20	.00	704.
1.01	.50	10	.01	.00	.01	2.	1.01	12.50	154	.21	.20	.00	708.
1.01	.55	11	.01	.00	.01	2.	1.01	12.55	155	.21	.20	.00	711.
1.01	1.00	12	.01	.00	.01	2.	1.01	13.00	156	.21	.21	.00	713.
1.01	1.05	13	.01	.00	.01	2.	1.01	13.05	157	.25	.25	.00	723.
1.01	1.10	14	.01	.00	.01	2.	1.01	13.10	158	.25	.25	.00	754.
1.01	1.15	15	.01	.00	.01	2.	1.01	13.15	159	.25	.25	.00	792.
1.01	1.20	16	.01	.00	.01	2.	1.01	13.20	160	.25	.25	.00	822.
1.01	1.25	17	.01	.00	.01	2.	1.01	13.25	161	.25	.25	.00	839.
1.01	1.30	18	.01	.00	.01	2.	1.01	13.30	162	.25	.25	.00	849.
1.01	1.35	19	.01	.00	.01	2.	1.01	13.35	163	.25	.25	.00	855.
1.01	1.40	20	.01	.00	.01	2.	1.01	13.40	164	.25	.25	.00	858.
1.01	1.45	21	.01	.00	.01	3.	1.01	13.45	165	.25	.25	.00	861.
1.01	1.50	22	.01	.00	.01	3.	1.01	13.50	166	.25	.25	.00	862.
1.01	1.55	23	.01	.00	.01	4.	1.01	13.55	167	.25	.25	.00	863.
1.01	2.00	24	.01	.00	.01	5.	1.01	14.00	168	.25	.25	.00	864.
1.01	2.05	25	.01	.00	.01	6.	1.01	14.05	169	.31	.31	.00	878.
1.01	2.10	26	.01	.00	.01	6.	1.01	14.10	170	.31	.31	.00	924.
1.01	2.15	27	.01	.00	.01	7.	1.01	14.15	171	.31	.31	.00	980.
1.01	2.20	28	.01	.00	.01	8.	1.01	14.20	172	.31	.31	.00	1025.
1.01	2.25	29	.01	.00	.01	9.	1.01	14.25	173	.31	.31	.00	1050.
1.01	2.30	30	.01	.00	.01	10.	1.01	14.30	174	.31	.31	.00	1065.
1.01	2.35	31	.01	.00	.01	11.	1.01	14.35	175	.31	.31	.00	1073.
1.01	2.40	32	.01	.00	.01	11.	1.01	14.40	176	.31	.31	.00	1078.
1.01	2.45	33	.01	.00	.01	12.	1.01	14.45	177	.31	.31	.00	1081.
1.01	2.50	34	.01	.00	.01	13.	1.01	14.50	178	.31	.31	.00	1083.
1.01	2.55	35	.01	.00	.01	13.	1.01	14.55	179	.31	.31	.00	1085.
1.01	3.00	36	.01	.00	.01	14.	1.01	15.00	180	.31	.31	.00	1085.
1.01	3.05	37	.01	.00	.01	15.	1.01	15.05	181	.19	.19	.00	1059.
1.01	3.10	38	.01	.00	.01	15.	1.01	15.10	182	.38	.38	.00	1013.
1.01	3.15	39	.01	.01	.01	16.	1.01	15.15	183	.38	.38	.00	1060.
1.01	3.20	40	.01	.01	.01	17.	1.01	15.20	184	.57	.57	.00	1165.
1.01	3.25	41	.01	.01	.01	17.	1.01	15.25	185	.67	.66	.00	1410.
1.01	3.30	42	.01	.01	.01	18.	1.01	15.30	186	1.62	1.61	.01	1906.
1.01	3.35	43	.01	.01	.01	18.	1.01	15.35	187	2.67	2.66	.01	3071.
1.01	3.40	44	.01	.01	.01	19.	1.01	15.40	188	1.05	1.04	.00	4485.
1.01	3.45	45	.01	.01	.01	19.	1.01	15.45	189	.67	.66	.00	4944.
1.01	3.50	46	.01	.01	.01	20.	1.01	15.50	190	.57	.57	.00	4381.
1.01	3.55	47	.01	.01	.01	20.	1.01	15.55	191	.38	.38	.00	3436.
1.01	4.00	48	.01	.01	.01	21.	1.01	16.00	192	.38	.38	.00	2677.
1.01	4.05	49	.01	.01	.01	21.	1.01	16.05	193	.29	.29	.00	2113.
1.01	4.10	50	.01	.01	.01	22.	1.01	16.10	194	.29	.29	.00	1703.
1.01	4.15	51	.01	.01	.01	22.	1.01	16.15	195	.29	.29	.00	1424.
1.01	4.20	52	.01	.01	.01	22.	1.01	16.20	196	.29	.29	.00	1250.
1.01	4.25	53	.01	.01	.01	23.	1.01	16.25	197	.29	.29	.00	1150.
1.01	4.30	54	.01	.01	.01	23.	1.01	16.30	198	.29	.29	.00	1094.
1.01	4.35	55	.01	.01	.01	24.	1.01	16.35	199	.29	.29	.00	1060.
1.01	4.40	56	.01	.01	.01	24.	1.01	16.40	200	.29	.29	.00	1038.
1.01	4.45	57	.01	.01	.01	24.	1.01	16.45	201	.29	.29	.00	1027.
1.01	4.50	58	.01	.01	.01	25.	1.01	16.50	202	.29	.29	.00	1022.
1.01	4.55	59	.01	.01	.01	25.	1.01	16.55	203	.29	.29	.00	1020.
1.01	5.00	60	.01	.01	.01	26.	1.01	17.00	204	.29	.29	.00	1019.

1.01	5.05	61	.01	.01	.01	26.	1.01	17.05	205	.23	.23	.00	1005.
1.01	5.10	62	.01	.01	.01	26.	1.01	17.10	206	.23	.23	.00	959.
1.01	5.15	63	.01	.01	.01	27.	1.01	17.15	207	.23	.23	.00	903.
1.01	5.20	64	.01	.01	.01	27.	1.01	17.20	208	.23	.23	.00	858.
1.01	5.25	65	.01	.01	.01	27.	1.01	17.25	209	.23	.23	.00	833.
1.01	5.30	66	.01	.01	.01	28.	1.01	17.30	210	.23	.23	.00	819.
1.01	5.35	67	.01	.01	.01	28.	1.01	17.35	211	.23	.23	.00	811.
1.01	5.40	68	.01	.01	.01	28.	1.01	17.40	212	.23	.23	.00	806.
1.01	5.45	69	.01	.01	.01	28.	1.01	17.45	213	.23	.23	.00	804.
1.01	5.50	70	.01	.01	.01	29.	1.01	17.50	214	.23	.23	.00	802.
1.01	5.55	71	.01	.01	.01	29.	1.01	17.55	215	.23	.23	.00	801.
1.01	6.00	72	.01	.01	.01	29.	1.01	18.00	216	.23	.23	.00	801.
1.01	6.05	73	.07	.04	.02	37.	1.01	18.05	217	.02	.02	.00	755.
1.01	6.10	74	.07	.04	.02	61.	1.01	18.10	218	.02	.02	.00	603.
1.01	6.15	75	.07	.04	.02	93.	1.01	18.15	219	.02	.02	.00	481.
1.01	6.20	76	.07	.05	.02	119.	1.01	18.20	220	.02	.02	.00	448.
1.01	6.25	77	.07	.05	.02	134.	1.01	18.25	221	.02	.02	.00	418.
1.01	6.30	78	.07	.05	.02	147.	1.01	18.30	222	.02	.02	.00	398.
1.01	6.35	79	.07	.05	.02	155.	1.01	18.35	223	.02	.02	.00	384.
1.01	6.40	80	.07	.05	.02	161.	1.01	18.40	224	.02	.02	.00	344.
1.01	6.45	81	.07	.05	.01	166.	1.01	18.45	225	.02	.02	.00	317.
1.01	6.50	82	.07	.05	.01	170.	1.01	18.50	226	.02	.02	.00	294.
1.01	6.55	83	.07	.05	.01	173.	1.01	18.55	227	.02	.02	.00	274.
1.01	7.00	84	.07	.05	.01	174.	1.01	19.00	228	.02	.02	.00	258.
1.01	7.05	85	.07	.05	.01	179.	1.01	19.05	229	.02	.02	.00	240.
1.01	7.10	86	.07	.05	.01	182.	1.01	19.10	230	.02	.02	.00	224.
1.01	7.15	87	.07	.05	.01	184.	1.01	19.15	231	.02	.02	.00	209.
1.01	7.20	88	.07	.05	.01	186.	1.01	19.20	232	.02	.02	.00	195.
1.01	7.25	89	.07	.06	.01	188.	1.01	19.25	233	.02	.02	.00	182.
1.01	7.30	90	.07	.06	.01	190.	1.01	19.30	234	.02	.02	.00	170.
1.01	7.35	91	.07	.06	.01	191.	1.01	19.35	235	.02	.02	.00	159.
1.01	7.40	92	.07	.06	.01	193.	1.01	19.40	236	.02	.02	.00	148.
1.01	7.45	93	.07	.06	.01	194.	1.01	19.45	237	.02	.02	.00	138.
1.01	7.50	94	.07	.06	.01	196.	1.01	19.50	238	.02	.02	.00	129.
1.01	7.55	95	.07	.06	.01	197.	1.01	19.55	239	.02	.02	.00	120.
1.01	8.00	96	.07	.06	.01	198.	1.01	20.00	240	.02	.02	.00	112.
1.01	8.05	97	.07	.06	.01	199.	1.01	20.05	241	.02	.02	.00	105.
1.01	8.10	98	.07	.06	.01	201.	1.01	20.10	242	.02	.02	.00	98.
1.01	8.15	99	.07	.06	.01	202.	1.01	20.15	243	.02	.02	.00	91.
1.01	8.20	100	.07	.06	.01	203.	1.01	20.20	244	.02	.02	.00	85.
1.01	8.25	101	.07	.06	.01	203.	1.01	20.25	245	.02	.02	.00	79.
1.01	8.30	102	.07	.06	.01	204.	1.01	20.30	246	.02	.02	.00	74.
1.01	8.35	103	.07	.06	.01	205.	1.01	20.35	247	.02	.02	.00	72.
1.01	8.40	104	.07	.06	.01	206.	1.01	20.40	248	.02	.02	.00	72.
1.01	8.45	105	.07	.06	.01	207.	1.01	20.45	249	.02	.02	.00	72.
1.01	8.50	106	.07	.06	.01	207.	1.01	20.50	250	.02	.02	.00	72.
1.01	8.55	107	.07	.06	.01	208.	1.01	20.55	251	.02	.02	.00	72.
1.01	9.00	108	.07	.06	.01	209.	1.01	21.00	252	.02	.02	.00	72.
1.01	9.05	109	.07	.06	.01	209.	1.01	21.05	253	.02	.02	.00	72.
1.01	9.10	110	.07	.06	.00	210.	1.01	21.10	254	.02	.02	.00	72.
1.01	9.15	111	.07	.06	.00	210.	1.01	21.15	255	.02	.02	.00	72.
1.01	9.20	112	.07	.06	.00	211.	1.01	21.20	256	.02	.02	.00	72.
1.01	9.25	113	.07	.06	.00	211.	1.01	21.25	257	.02	.02	.00	72.
1.01	9.30	114	.07	.06	.00	212.	1.01	21.30	258	.02	.02	.00	72.
1.01	9.35	115	.07	.06	.00	212.	1.01	21.35	259	.02	.02	.00	72.
1.01	9.40	116	.07	.06	.00	213.	1.01	21.40	260	.02	.02	.00	72.
1.01	9.45	117	.07	.06	.00	213.	1.01	21.45	261	.02	.02	.00	72.
1.01	9.50	118	.07	.06	.00	214.	1.01	21.50	262	.02	.02	.00	72.
1.01	9.55	119	.07	.06	.00	214.	1.01	21.55	263	.02	.02	.00	72.
1.01	10.00	120	.07	.06	.00	215.	1.01	22.00	264	.02	.02	.00	72.

1.01	10.05	121	.07	.06	.00	215.	1.01	22.05	265	.02	.02	.00	72.
1.01	10.10	122	.07	.06	.00	215.	1.01	22.10	266	.02	.02	.00	72.
1.01	10.15	123	.07	.06	.00	214.	1.01	22.15	267	.02	.02	.00	72.
1.01	10.20	124	.07	.06	.00	214.	1.01	22.20	268	.02	.02	.00	72.
1.01	10.25	125	.07	.06	.00	216.	1.01	22.25	269	.02	.02	.00	72.
1.01	10.30	126	.07	.06	.00	217.	1.01	22.30	270	.02	.02	.00	72.
1.01	10.35	127	.07	.06	.00	217.	1.01	22.35	271	.02	.02	.00	72.
1.01	10.40	128	.07	.06	.00	217.	1.01	22.40	272	.02	.02	.00	72.
1.01	10.45	129	.07	.06	.00	217.	1.01	22.45	273	.02	.02	.00	72.
1.01	10.50	130	.07	.06	.00	218.	1.01	22.50	274	.02	.02	.00	72.
1.01	10.55	131	.07	.06	.00	218.	1.01	22.55	275	.02	.02	.00	72.
1.01	11.00	132	.07	.06	.00	218.	1.01	23.00	276	.02	.02	.00	72.
1.01	11.05	133	.07	.06	.00	218.	1.01	23.05	277	.02	.02	.00	72.
1.01	11.10	134	.07	.06	.00	219.	1.01	23.10	278	.02	.02	.00	72.
1.01	11.15	135	.07	.06	.00	219.	1.01	23.15	279	.02	.02	.00	72.
1.01	11.20	136	.07	.06	.00	219.	1.01	23.20	280	.02	.02	.00	72.
1.01	11.25	137	.07	.06	.00	219.	1.01	23.25	281	.02	.02	.00	72.
1.01	11.30	138	.07	.06	.00	219.	1.01	23.30	282	.02	.02	.00	72.
1.01	11.35	139	.07	.06	.00	220.	1.01	23.35	283	.02	.02	.00	72.
1.01	11.40	140	.07	.06	.00	220.	1.01	23.40	284	.02	.02	.00	72.
1.01	11.45	141	.07	.06	.00	220.	1.01	23.45	285	.02	.02	.00	72.
1.01	11.50	142	.07	.06	.00	220.	1.01	23.50	286	.02	.02	.00	72.
1.01	11.55	143	.07	.06	.00	220.	1.01	23.55	287	.02	.02	.00	72.
1.01	12.00	144	.07	.06	.00	220.	1.02	0.00	288	.02	.02	.00	72.
									SUM	32.24	30.86	1.38	110866.
										(819.)	(785.)	(35.)	(2739.38)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4944.	1194.	385.	385.	110831.
CMS	140.	34.	11.	11.	3138.
INCHES		24.44	31.75	31.75	31.75
MM		625.74	806.45	806.45	806.45
AC-FT		592.	763.	763.	763.
THOUS CU M		731.	942.	942.	942.

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	100.00	100.00	104.50
STORAGE	75.	75.	122.
OUTFLOW	0.	0.	106.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	104.27	0.00	119.	81.	0.00	17.58	0.00
.15	105.15	.65	131.	303.	2.83	16.08	0.00
.20	105.70	1.20	139.	432.	3.58	15.92	0.00
.25	106.03	1.53	143.	900.	4.67	15.92	0.00
.30	106.24	1.74	146.	1139.	5.42	15.92	0.00
.35	106.43	1.93	149.	1354.	6.00	15.92	0.00
.40	106.61	2.11	152.	1602.	6.58	15.83	0.00
.50	106.92	2.42	156.	2089.	7.42	15.83	0.00
1.00	107.89	3.39	171.	4594.	11.33	15.83	0.00

PLATE A-1
Sheet 5 of 5

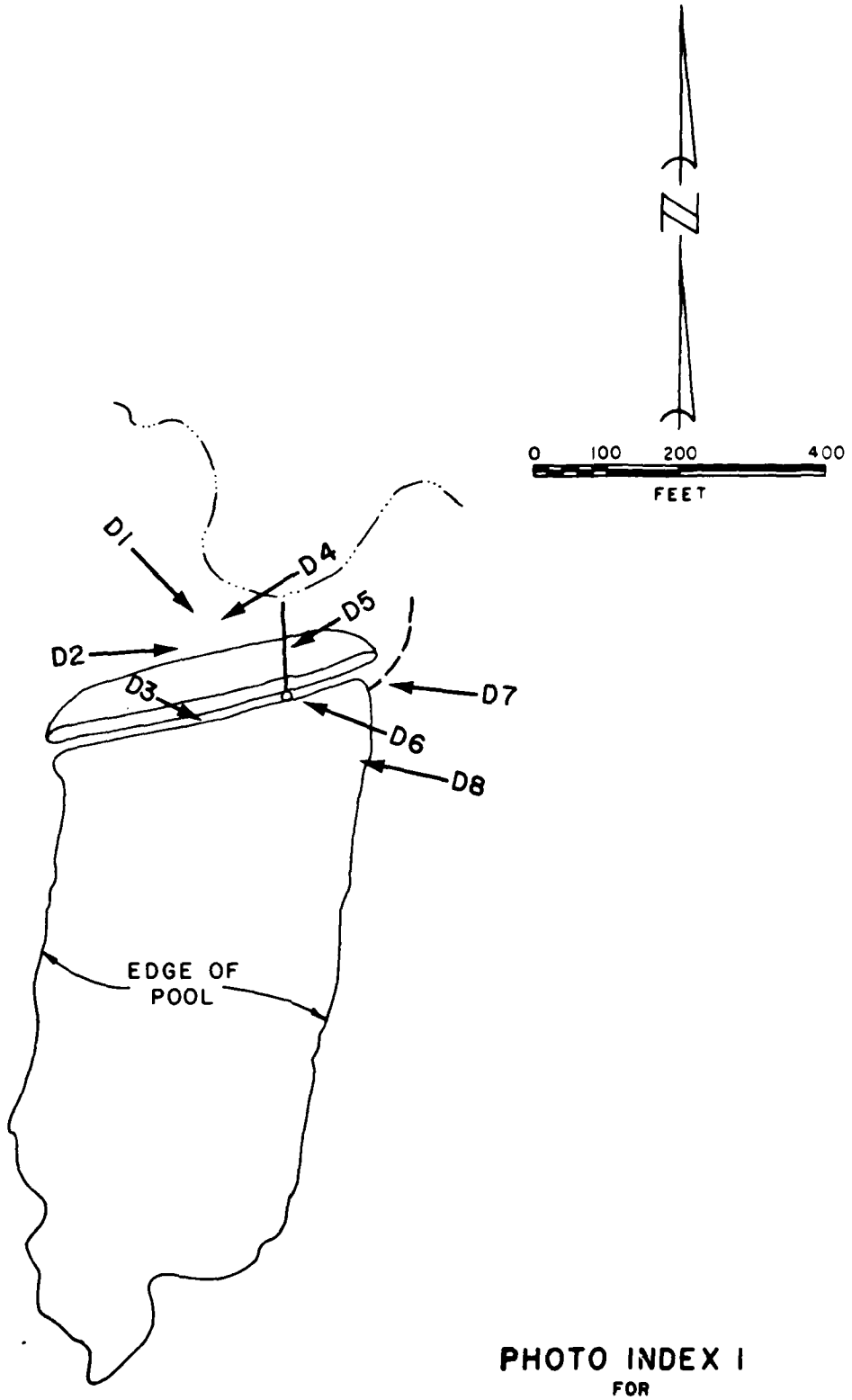
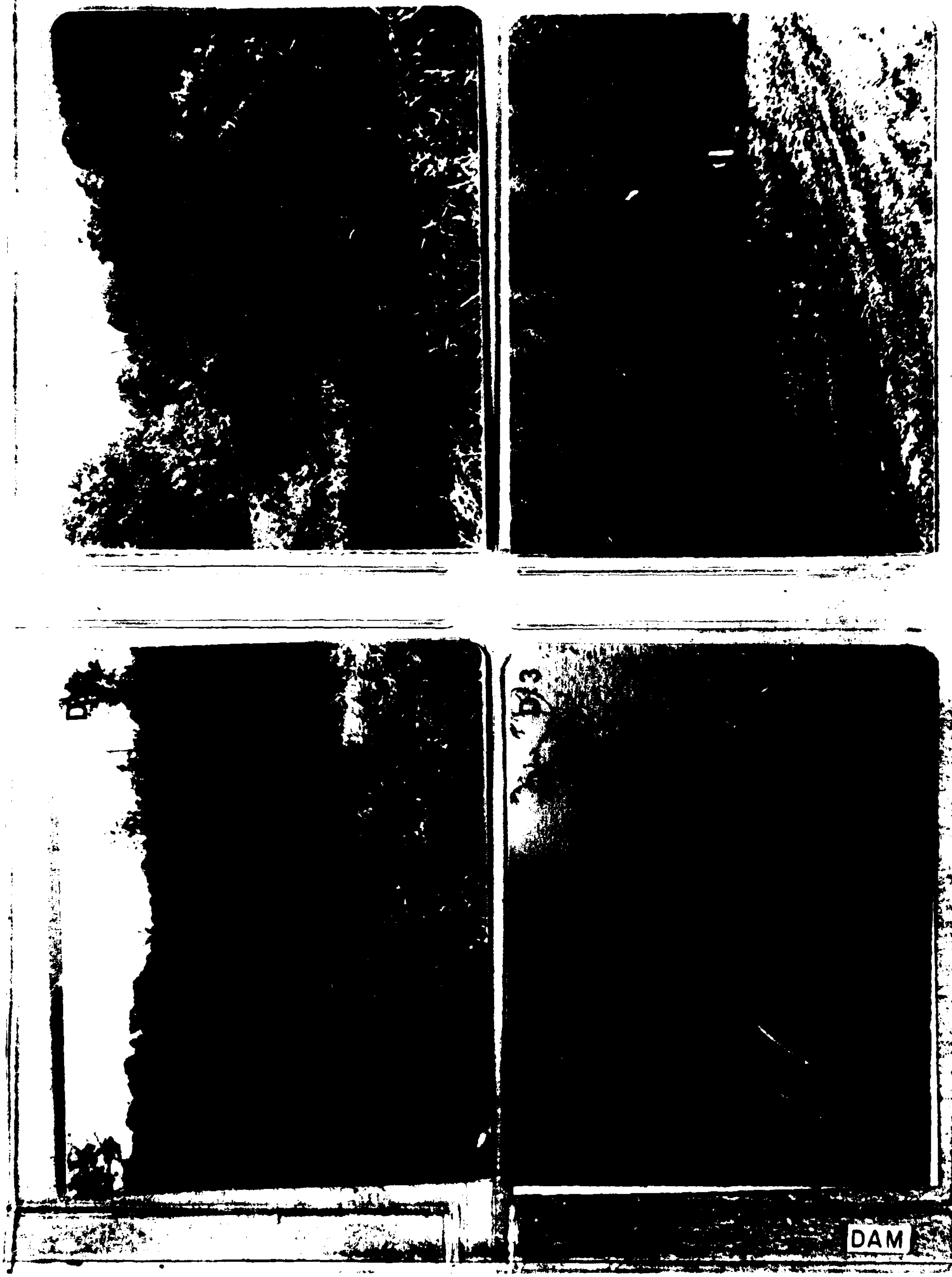
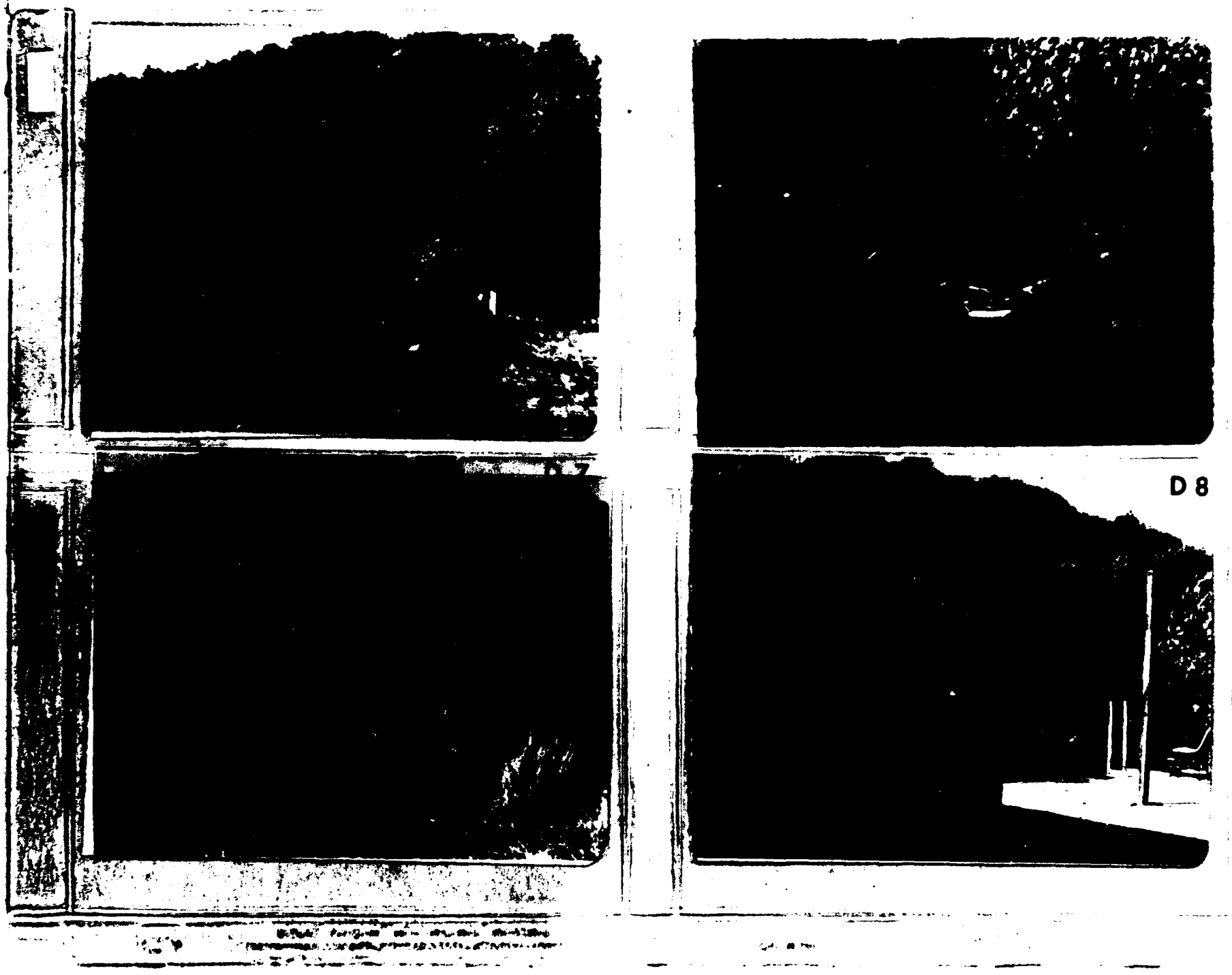


PHOTO INDEX I
FOR
DAM

ROBERT SCHULTEHENRICH DAM
ST. CHARLES COUNTY, MO.
NOVEMBER 1978

PREPARED BY
REITZ & JENS, INC.


DAM



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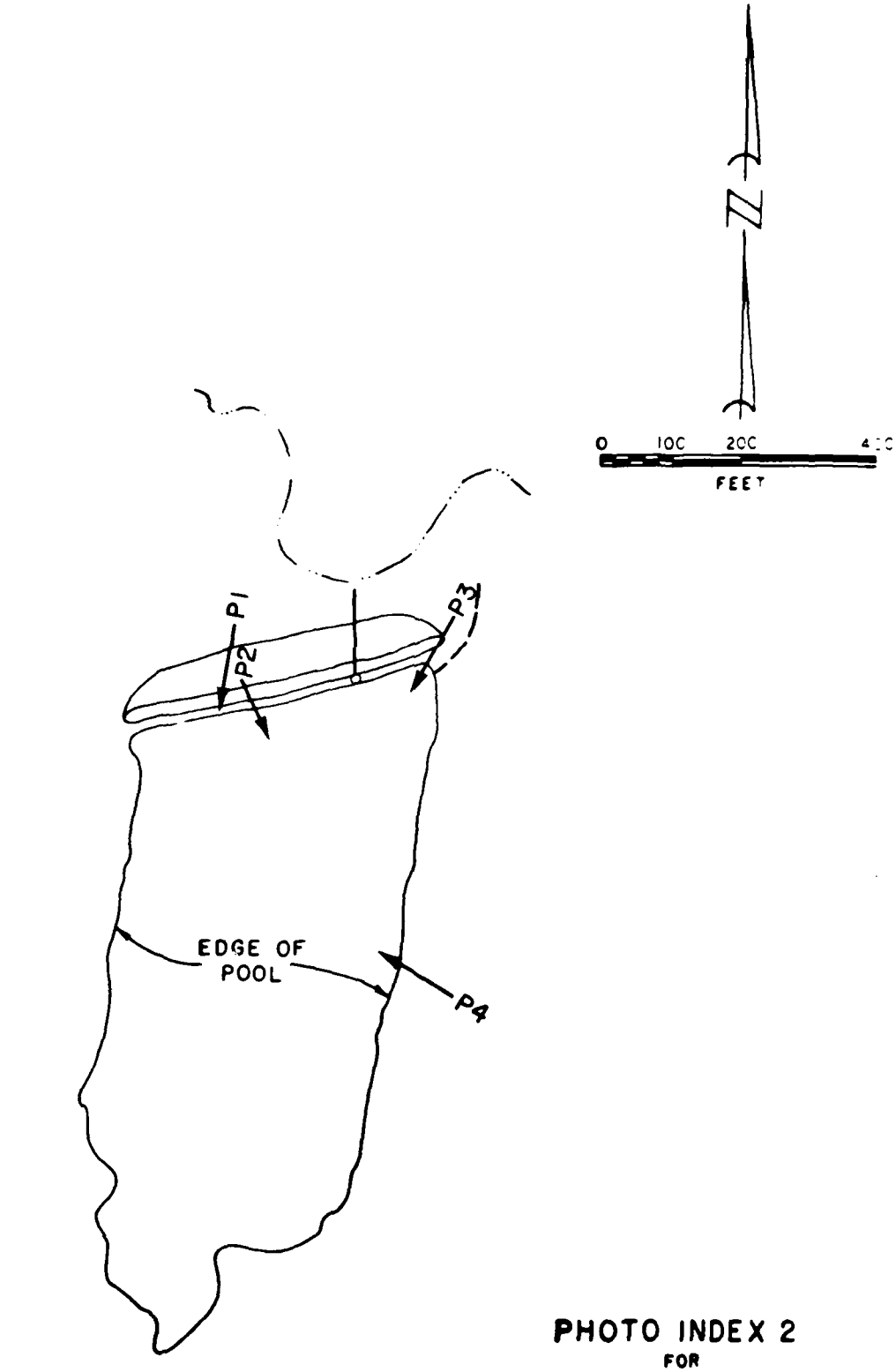
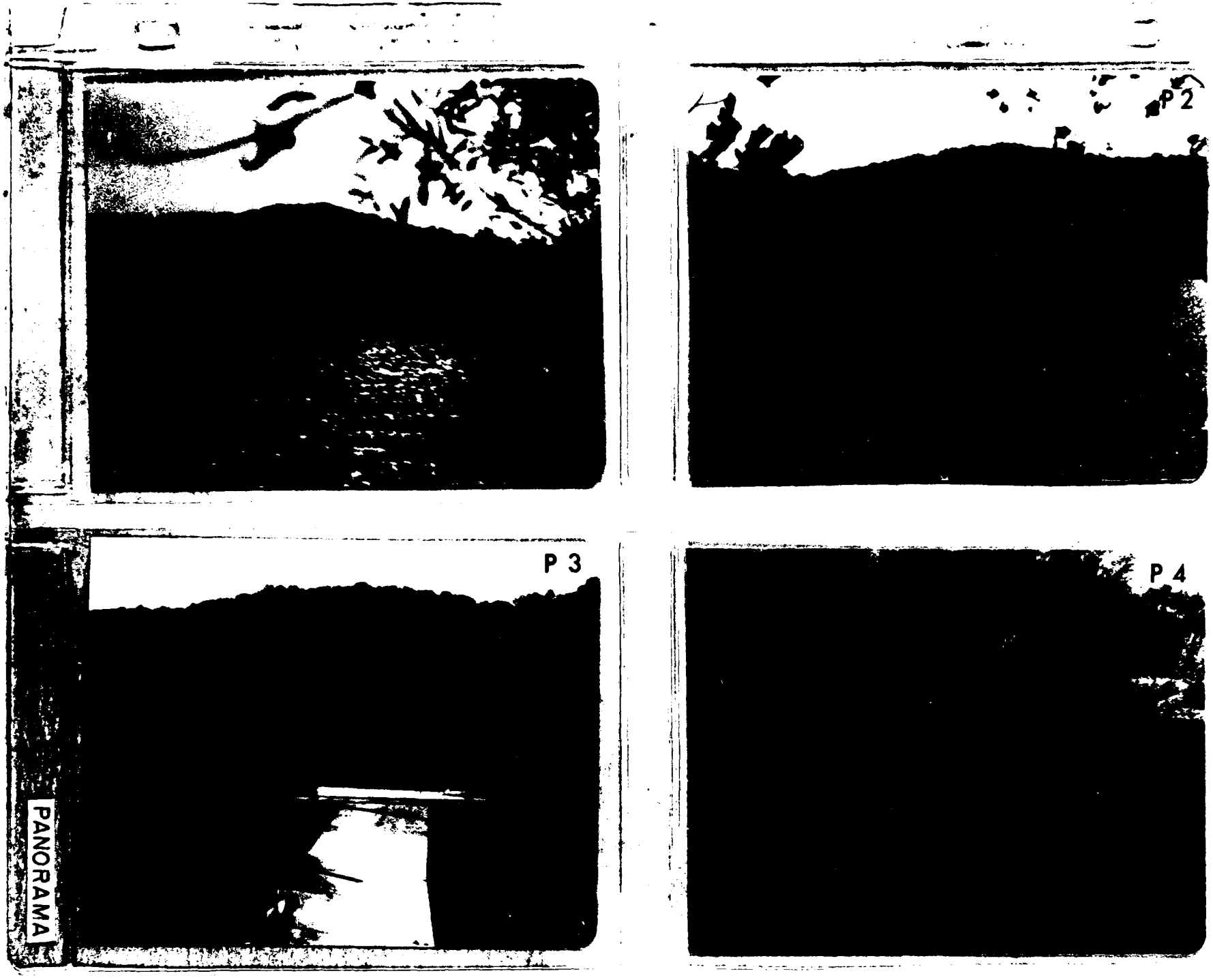


PHOTO INDEX 2
FOR
PANORAMA

ROBERT SCHULTEHENRICH DAM
ST. CHARLES COUNTY, MO
NOVEMBER 1978

PREPARED BY
REITZ & JENS, INC


P 2
P 3
P 4
PANORAMA

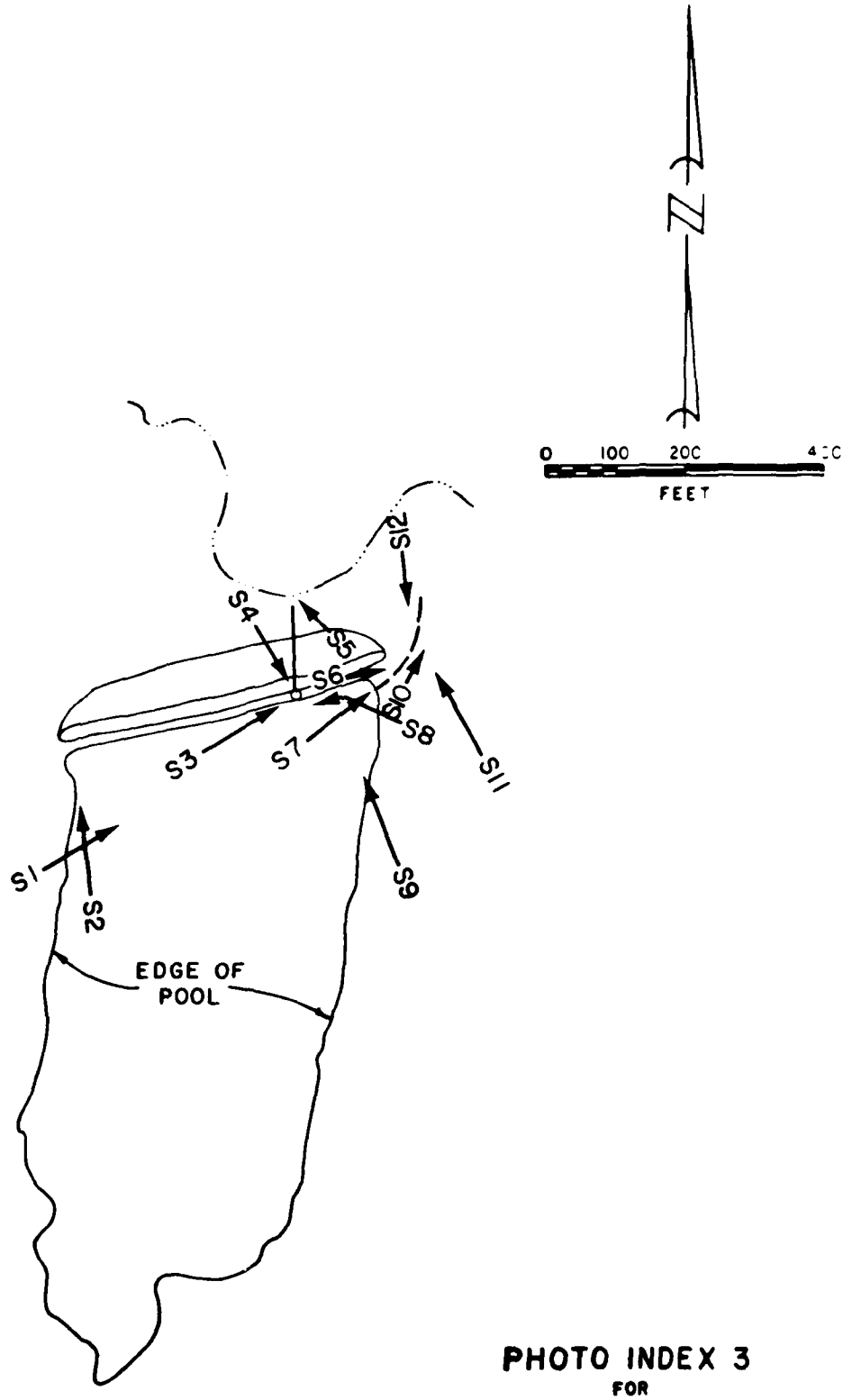
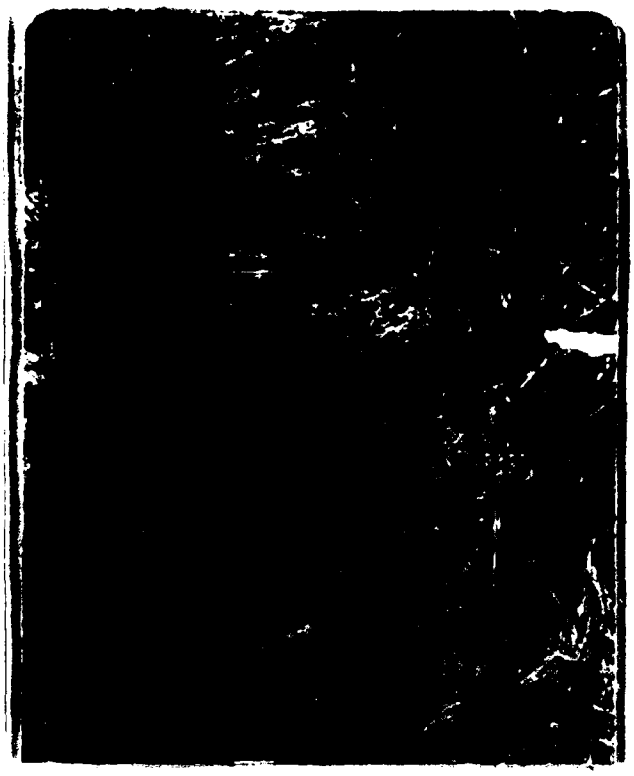


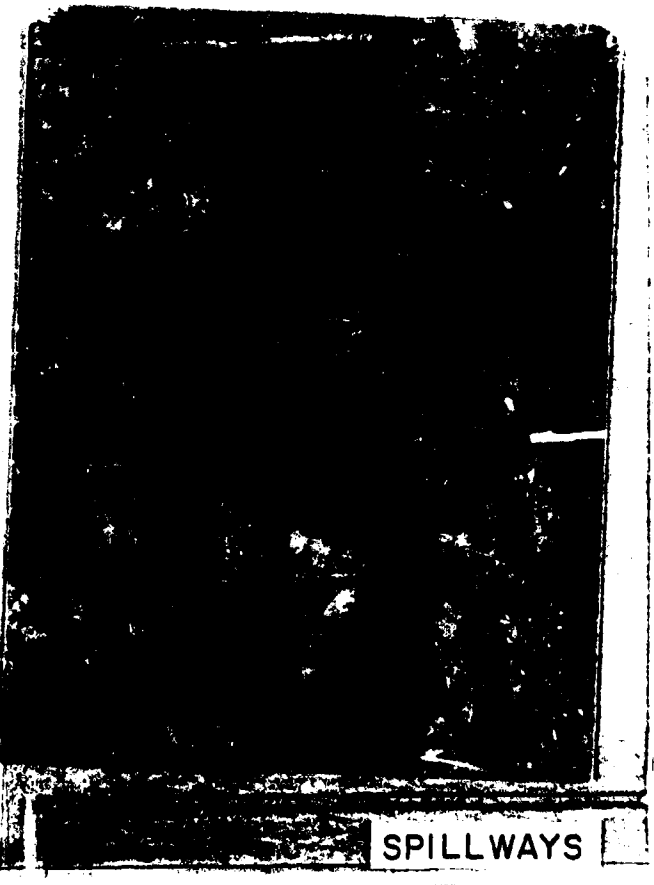
PHOTO INDEX 3
FOR
SPILLWAY

ROBERT SCHULTEHENRICH DAM
ST. CHARLES COUNTY, MO
NOVEMBER 1978

PREPARED BY
REITZ & JENS, INC

SPILLWAYS





SPILLWAYS

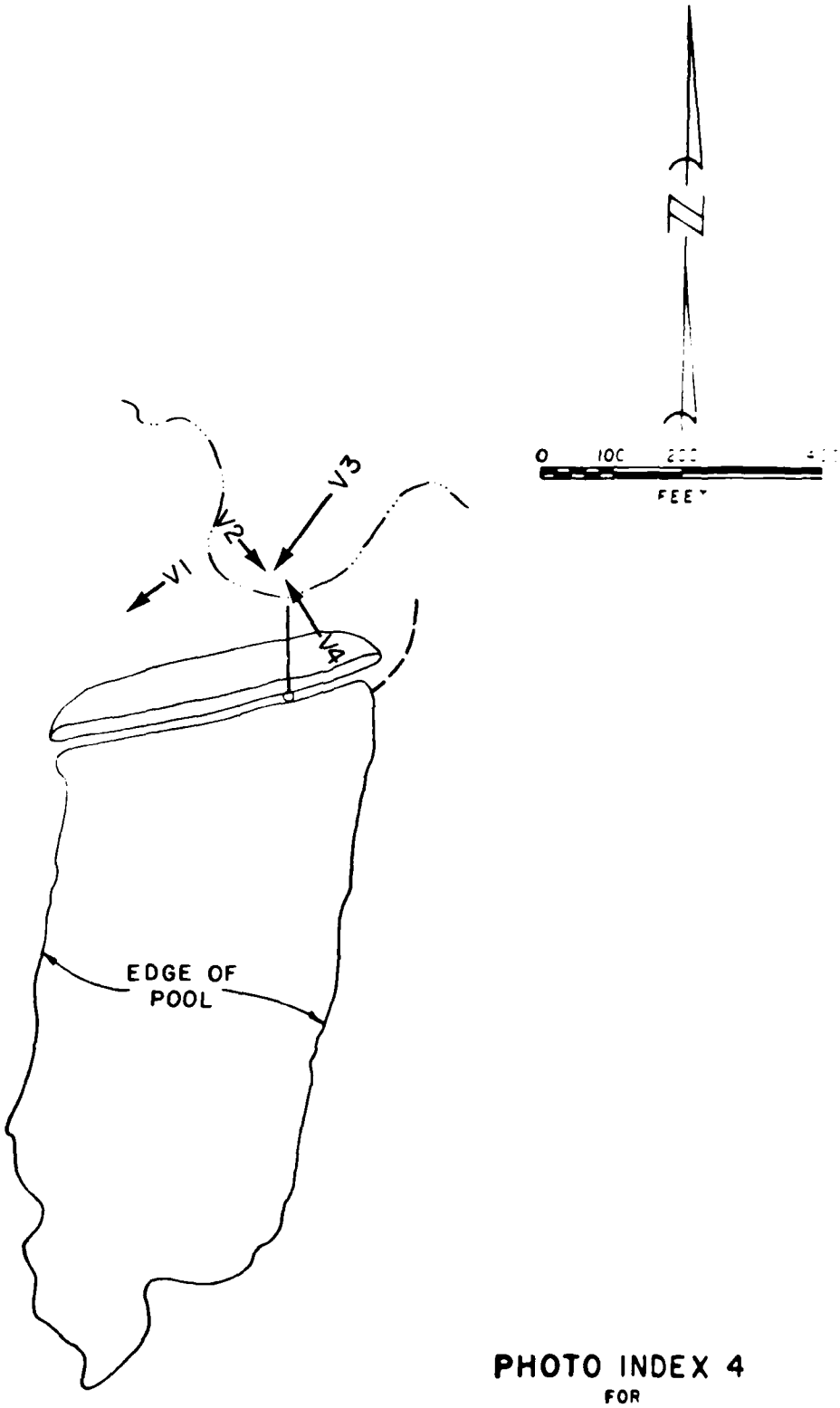
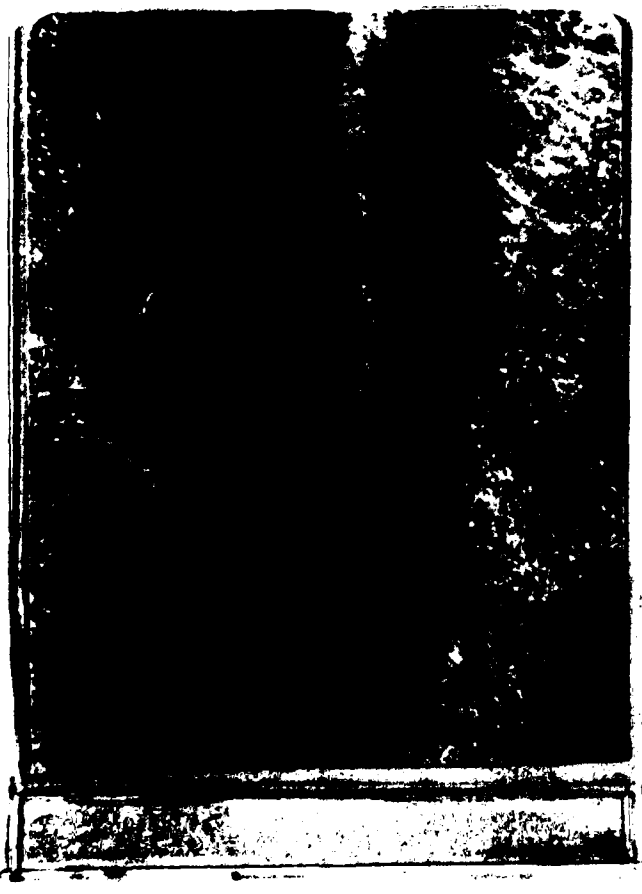


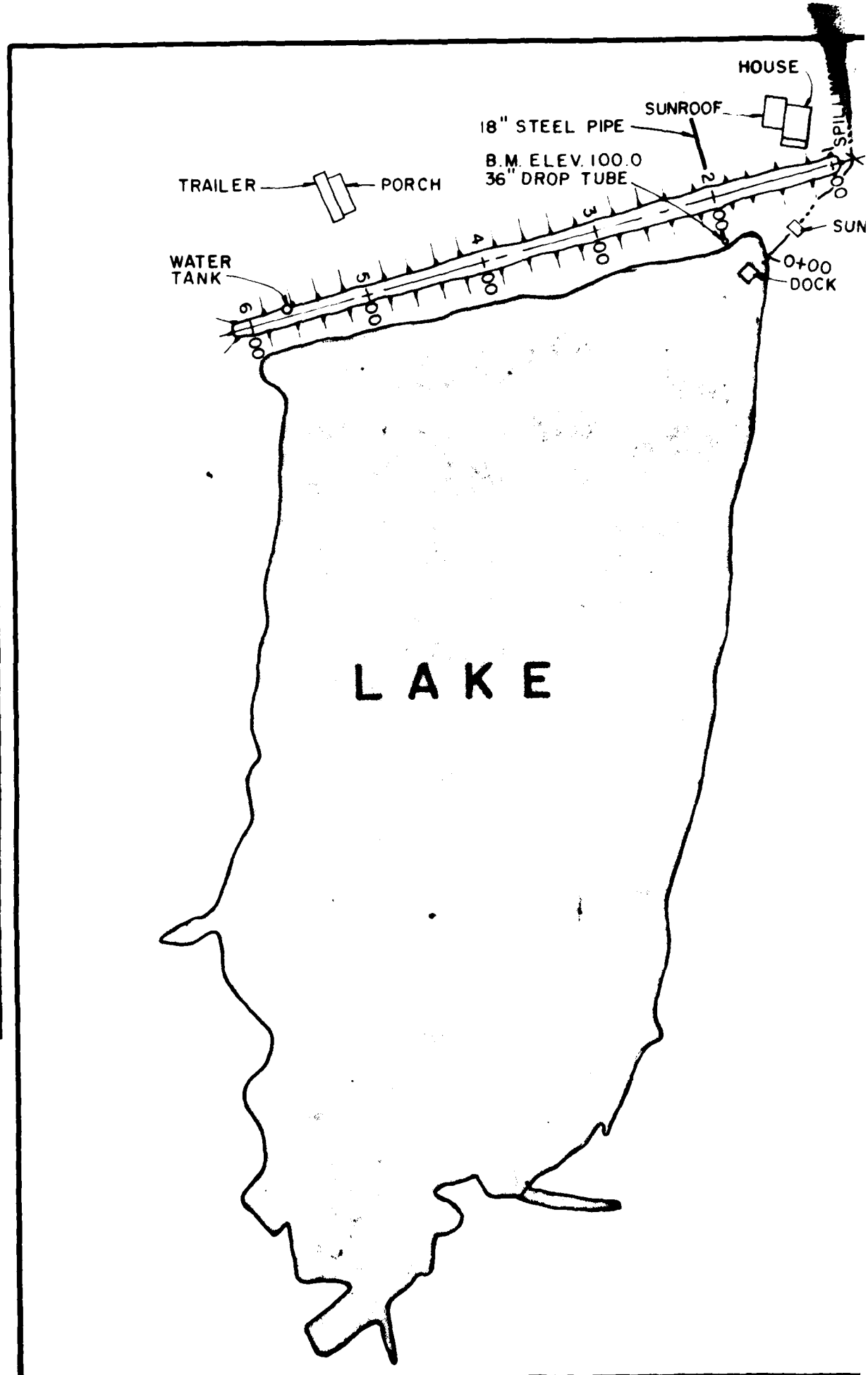
PHOTO INDEX 4
FOR
VALLEY BELOW DAM

ROBERT SCHULTEHENRICH DAM
ST. CHARLES COUNTY, MO
NOVEMBER 1978

PREPARED BY
REITZ & JENS, INC



VALLEY BELOW DAM



FINAL SURVEY		DATE
NOTE BOOK NO	SURVEYED	BY
	PLOTTED	
	TEMPLATE	
	AREAS	
	AREAS CHECKED	

0+00

1+00

UNROOF

N

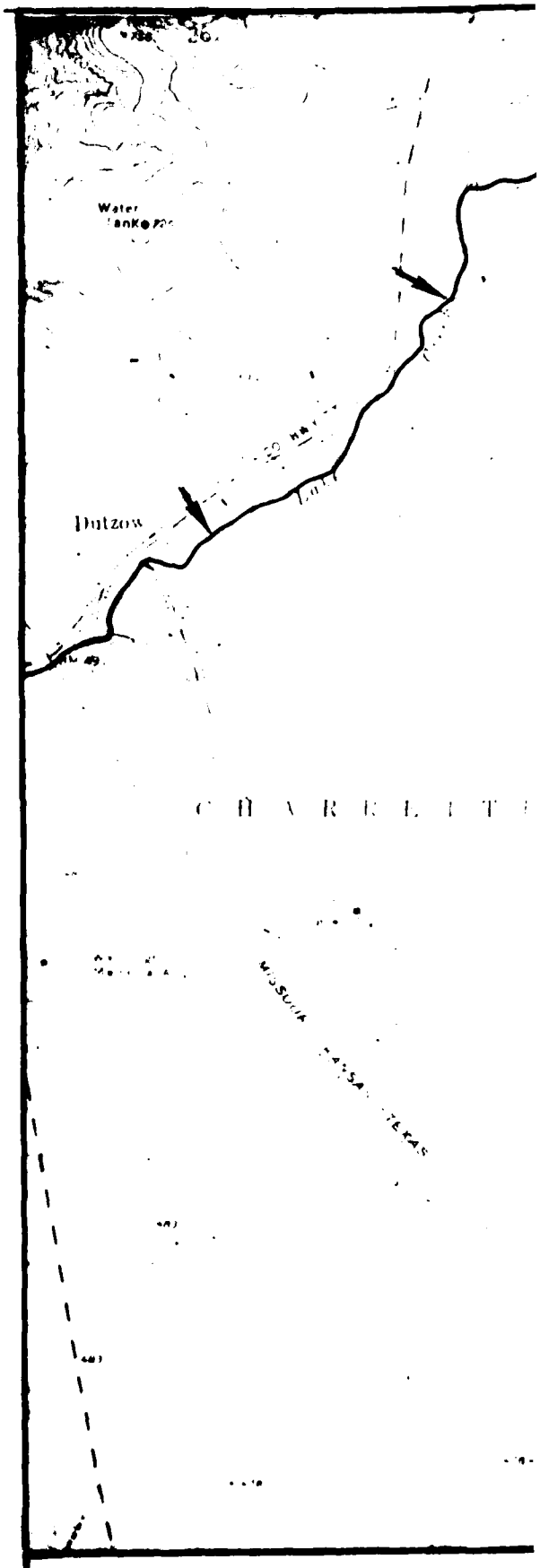
PLAN OF LA

0 100

℄ OF 36" DIAM.
INTAKE PIPE

℄ OF DAM

2

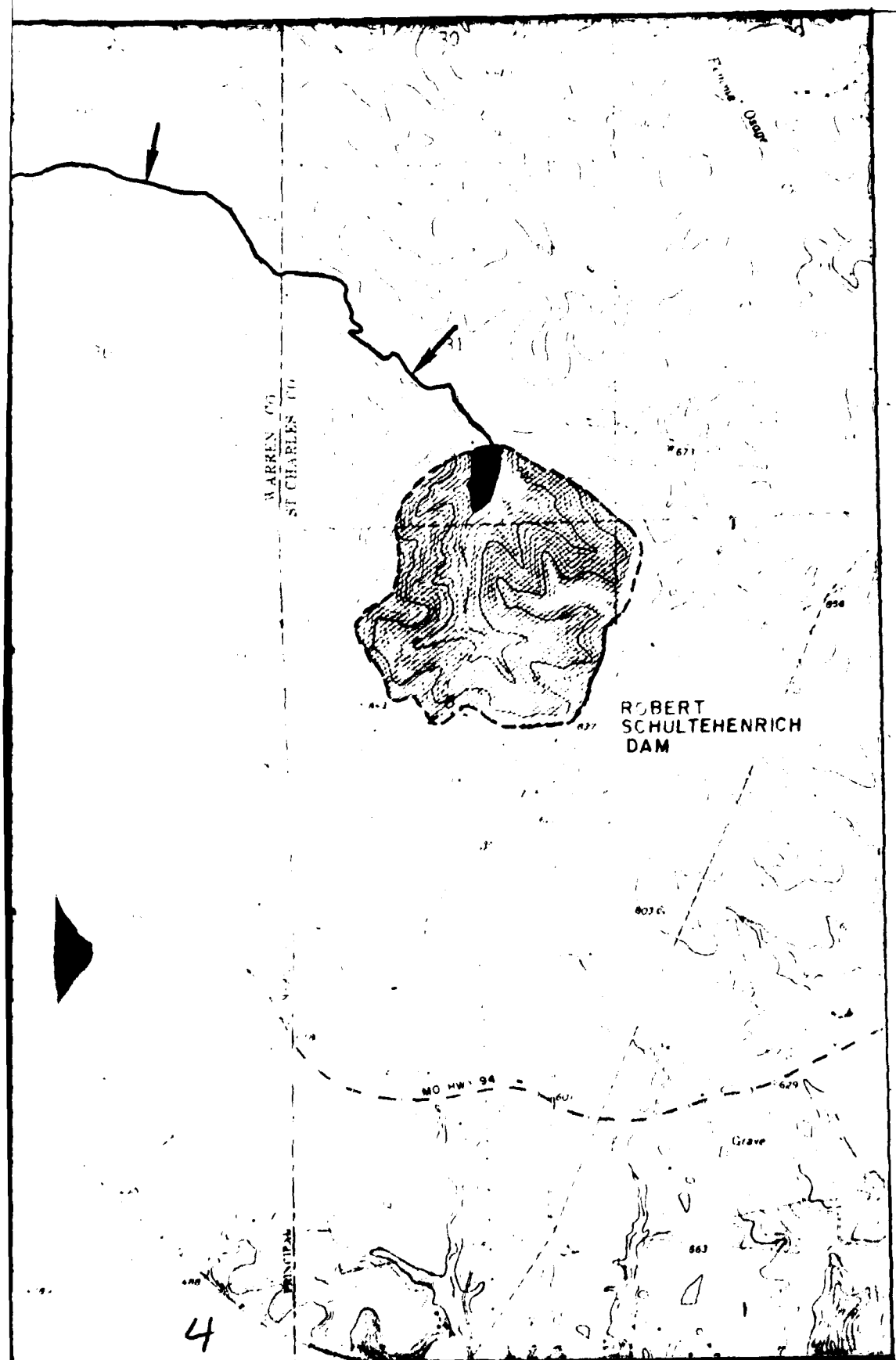


F LAKE

400 FT.

3

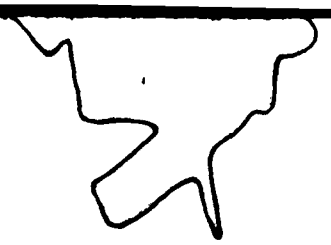
WATERS



4

RSHED AND OUTFLOW CHANNEL

0 1000 2000 4000 6000 FT.



PLAN OF DAM AND SPILLWAY

0 50 100 200 300 FT

ORIGINAL SURVEY

NOTE BOOK NO

BY

DATE

SURVEYED

PLOTTED

TEMPLATE

AREAS

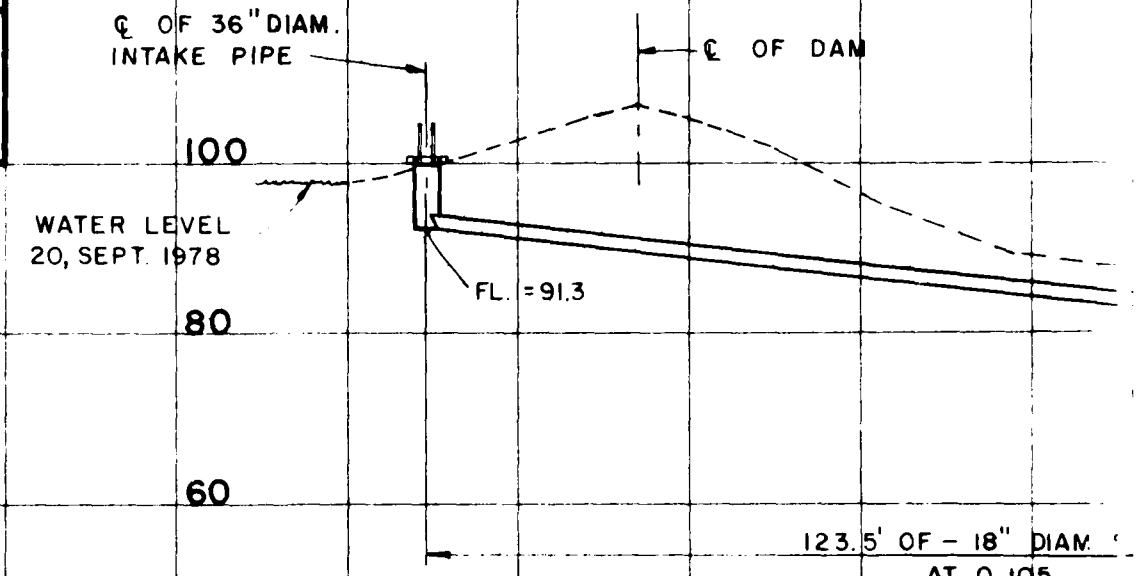
AREA CHK'D

5

2

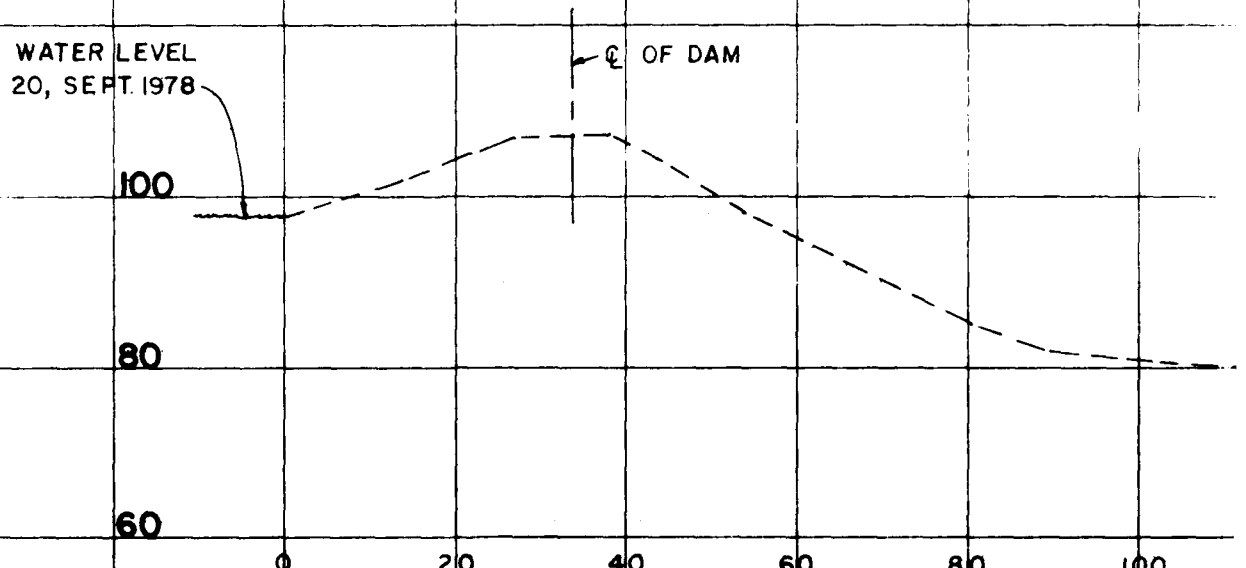
PLAN OF L

0 100 200



SECTIO

AT S



SECTIC

AT S

6

HIGHWAY FEDER

PLATE 4-SINGLE PLAN AND

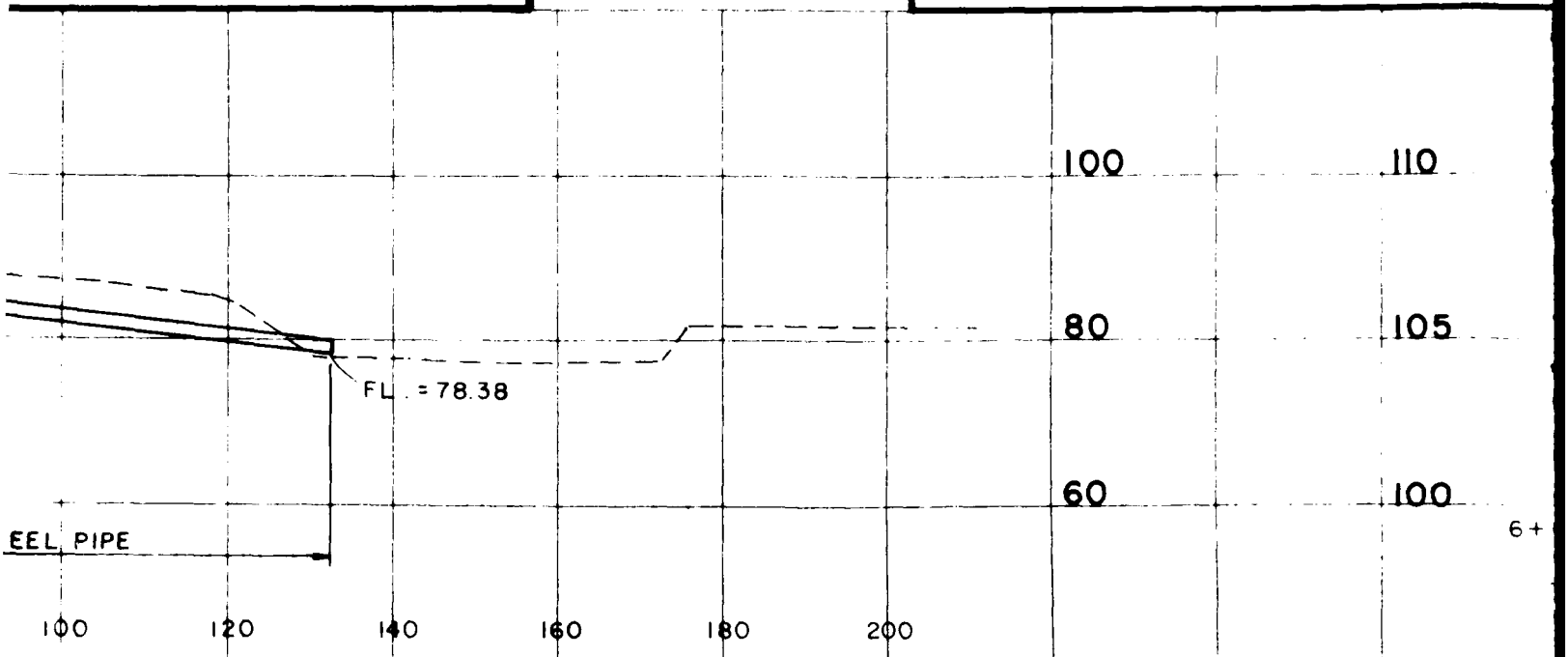
TELEDYNE NATION

INDIANAPOLIS, INDIANA

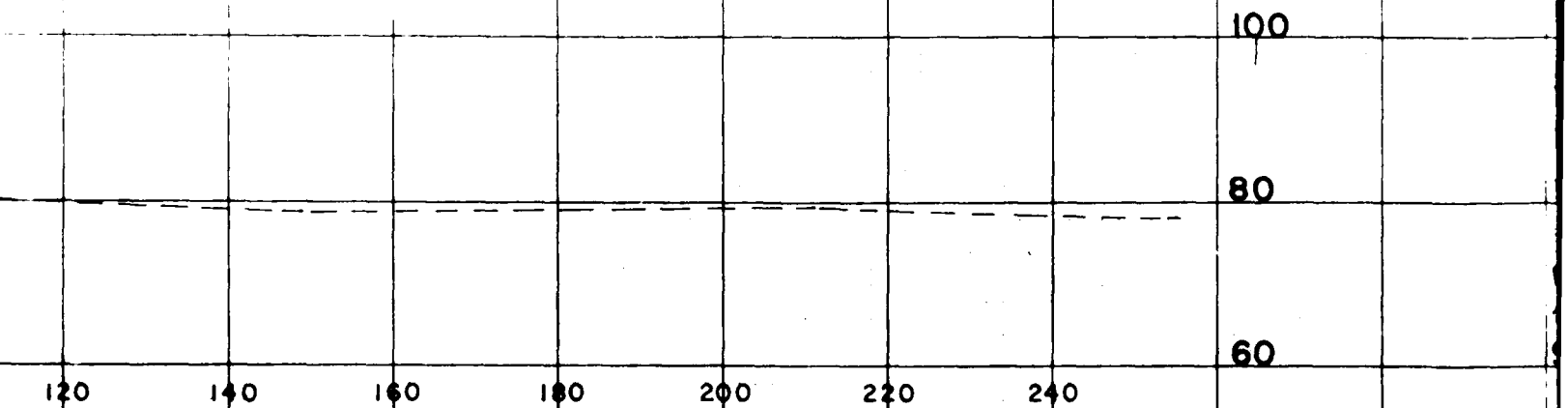
AKE 3

400 FT

WATERSHED



N OF DAM
STA 2+00



N OF DAM
STA 4+17

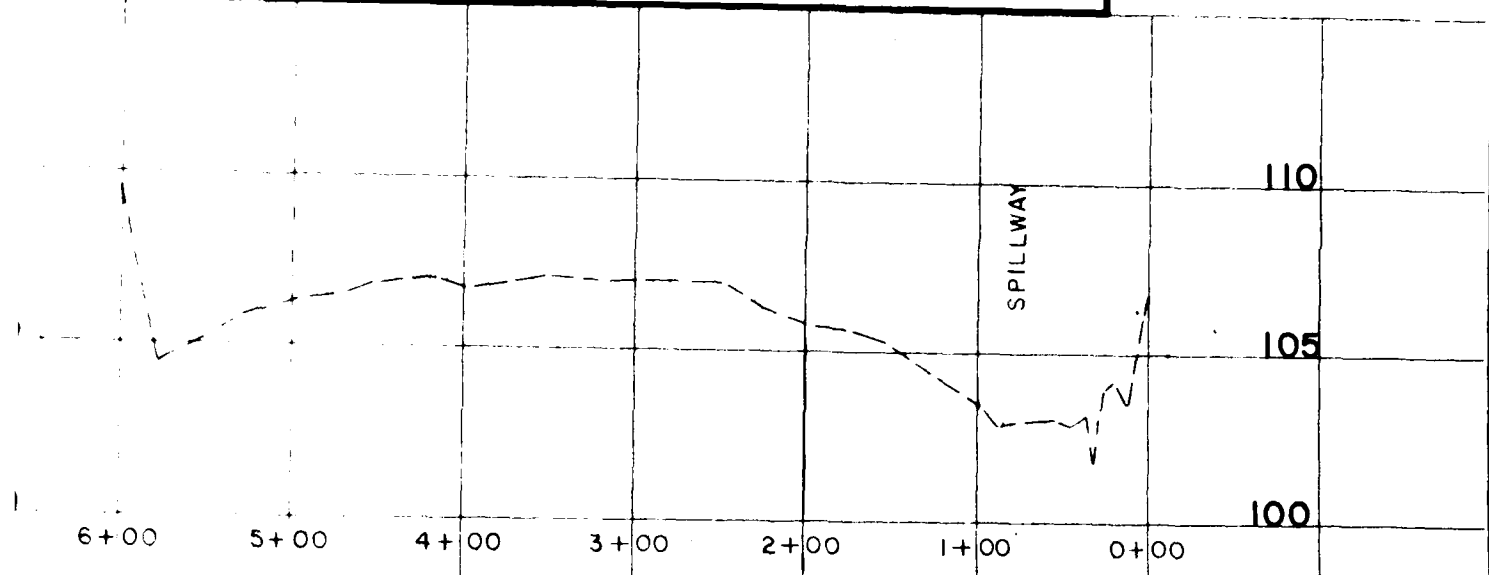
ROBERT SCHULTE HENRICH DAM

L AID SHEET
CROSS SECTION-LINE & DOT 7
L TRACING PAPER
PRINTED IN U.S.A.

4

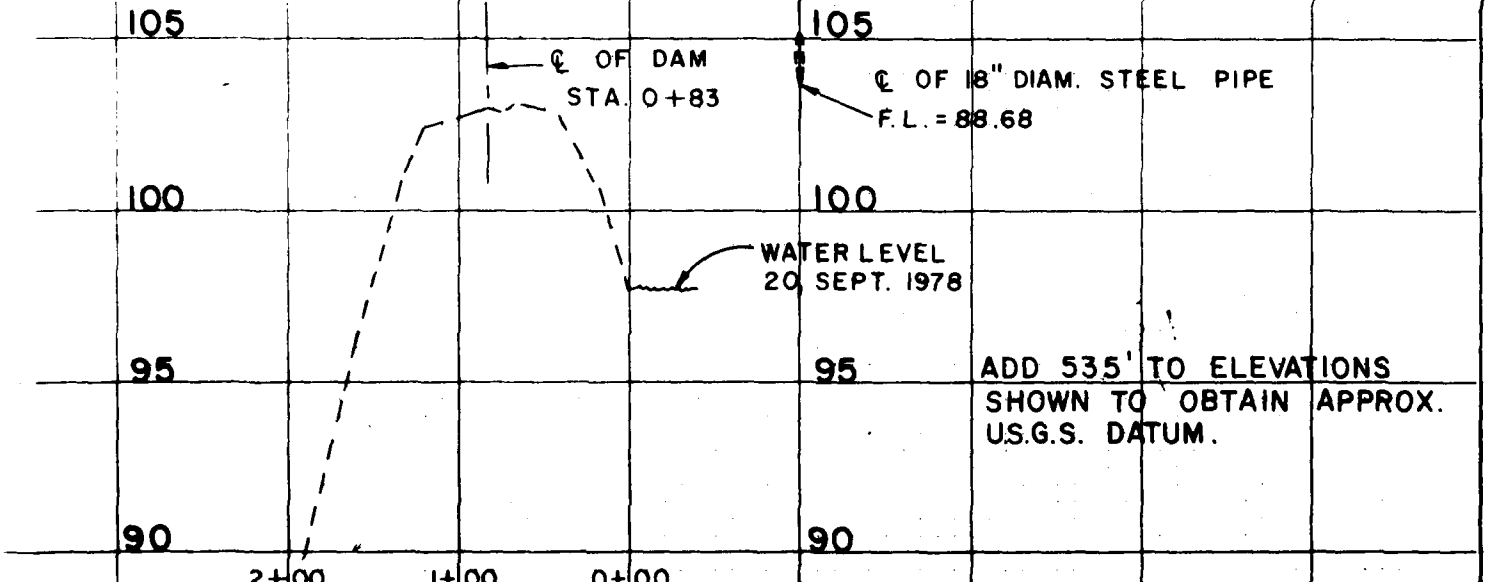
SHED AND OUTFLOW CHANNEL

4000 6000 FT



PROFILE OF TOP OF DAM

SCALES
1" = 5' VERT.
1" = 100' HORIZ.



PROFILE OF SPILLWAY

SCALES
1" = 5' VERT.
1" = 100' HORIZ.

DAM

PHASE I - INSPECTION
COUNTY I.D. NO. 183
ST. CHARLES COUNTY, MISSOURI

INVENTORY NO. I D. 30294

FOR ST. LOUIS DISTRICT, CORPS OF ENGINEERS

REITZ & JENS, INC.
CONSULTING ENGINEERS

ST. LOUIS, MISSOURI
OCTOBER 1978

8

PLATE 3

END

DATE
FILMED

11-81

DTIC